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CAPE OF GOOD HOPE.

DEPARTMENT OF AGRICULTURE.

MANUAL

OF

PRACTICAL ORCHARD-WORK AT THE CAPE.

BY

P. MEGOWAN AND EUSTACE POTTER.

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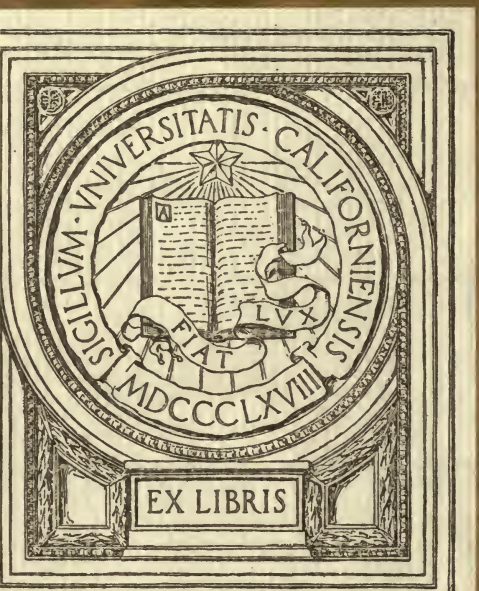

UNIVERSITY FARM

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No. 4, 1896.]

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P. MacOWAN AND EUSTACE PILLANS.

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PREFACE.

At the suggestion of the Under Secretary for Agriculture this pamphlet upon Orchard practice has been prepared, as a precursor to a work of closer local application for which the data do not yet exist. Time only can show how far it meets a present want. Throughout an effort has been made to avoid empirical rules without reasons, to state in the simplest manner such laws of vegetative life as particularly concern the fruit-grower, and from them to deduce as necessary consequences the correct rules of practice. It is not possible to produce a manual of universal application in a country like the Cape which has two distinct and conversely differing climates of west and east, and where the variations are further accentuated by the rapid increase of altitude as one passes inland. The writers hope that by the observations and data furnished by intelligent cultivators in these very divergent intercolonial climates, it may be possible hereafter to define with more accuracy the climatic areas and approximate altitudes which demand variations in gardening practice no less than in the objects of culture. The pamphlet will have fulfilled its purpose if it enforces attention to the points most neglected in fruit-culture. These are the incredible neglect of the mechanical condition of the soil and general avoidance of deep trenching, the unintelligent use of irrigation, the absence of any effective system of sub-drainage, unscientific pruning both formative and in maintenance, and an easy satisfaction with seedlings that have thrown back, instead of growing only pedigree sorts propagated by bud and graft. Reform of cultural custom and practice on these five points lies at the foundation of all improvement in Cape fruit growing.

P. MacOwan, F.L.S., F.R.H.S., &c.

Eustace Pillans, Agricultural Assistant.

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PRACTICAL ORCHARD-WORK AT THE CAPE.

The Artificial Character of Modern Fruit Trees.

1. Cultivation implies, first, a previous knowledge of the nature and constitution of the living being we propose to care for, and secondly, a previous knowledge of the soil and atmosphere in which it holds its dual life. It is only by such preknowledge that the cultivator can suit the conditions of growth to the wants of the thing to be grown, and thus place it in the best possible position for fulfilling the history of its life. Nothing short of this work, done of set purpose and as the outcome of exact knowledge, can be called *cultivation*.

2. But it is something more than this. It is not enough to reproduce plants in the precise form in which they exist in nature. Firstly, the cultivator, for his own benefit, aims at guiding and controlling the growth of certain plants so as to make them develop very differently from their normal original condition. Thus in one plant he endeavours to obtain seeds of large size and bland taste, in another the effort is to do away with seeds as far as possible and produce a large succulent fruit, in others, shortening of the axial growth, and great enlargement of the leaves is aimed at. The plant then with certain limits is, like clay in the hands of the potter, capable of being remodelled, by causing this or that organ to take on an excessive and unusual development, without at the same time interfering with the balance of functions necessary for its general health. This complex art is one great part of *cultivation*. To practice it with success obviously demands something more than the loose, popular notions of plant-life, which are picked up without special study or thought, or come by imitating the traditional methods of our neighbours.

3. Secondly.—For many hundreds of years a close watch has been kept upon the seedlings arising in the reproduction of all cultivated plants. Whenever a sport or other chance variation has appeared, presenting characters of a

desirable kind, the gardener has been quick to detect it, and by budding or grafting to give it permanence. And this continual watchfulness, awaiting the chance of betterment by natural variation, has produced the fruit and vegetable sorts approved and kept in being all over the world, so that in orcharding, as in all knowledge and civilization, we are to-day the heirs of countless unknown benefactors who have preceded us and handed down to us their best results. It must therefore be constantly kept in mind that the objects of our culture are distinctly artificial products obtained by centuries of selection and variation, and do not exist as wildings, nor can they put up with the conditions sufficient for wildings. As soon as skilled care ceases they cannot escape deterioration, and ultimately dying out. And that indispensable skilled care is orchard-work, a branch of cultivation in the wider sense, and is just as essential as the quick-witted observation which has detected chance improved variations when they do occur, and fixed them for all time.

The Construction and Function of the Root.

4. The descending axis which fixes the root in the ground by means of its numerous branches, has a central cylinder of wood-tissue, in which are large vessels, big enough to be recognised easily when cut across with a sharp knife. Round this is a layer of softer tissue, sheathing it completely. It is convenient to call it the *cortex*, because the word *bark* is used in a loose indefinite sense. In a seedling the cortex of the root is extremely delicate, almost transparent, and absorptive of moisture. In a mature tree the enlarged roots, popularly so called, have entirely lost the power of vitally absorbing water from the soil. They collect nothing whatever, their duty being to maintain the stability of the tree and to conduct away upwards through their woody central cylinder the fluid obtained from the soil for the use of the stem and foliage.

5. Then what part of the root does drink up the fluid food-material from the soil? Only a portion behind the extreme end of each delicate root-tip. This absorptive region is covered with fine root-hairs forming often a

Figure 1.

close pile like velvet, and thus enormously increasing the surface through which water can be taken up. It has not yet hardened and become discoloured. Long before this change has taken place the hairs drop off, and the portion of the rootlet on which they grew is comparatively useless for purpose of absorption. Meanwhile the tip of the rootlet has pushed further into the soil. New root-hairs have arisen on the newly-grown length, and they in their turn fulfil the duty required. The actual growing tip itself absorbs but little. It is covered with a protective cap of tissue, which is constantly wearing away and as constantly being renewed, and which serves to protect it from actual contact with the particles of the soil through which it is forcing its way.

6. All these facts can easily be demonstrated. A rape seedling carefully taken up exhibits the naked apex of the main root and the zone of root-hairs at some distance behind covered with adherent particles of soil. If these be gently washed off the close pile of hairs comes distinctly into view. Each hair is hollow and opens directly into some one cell of the root-wall, even as the finger of a glove opens into the cavity left for the palm of the hand.

7. Then it would seem that the transplant-trees one is accustomed to receive, with no ball of their original earth

Figure 1.—Root-hairs of a young wheat-plant.

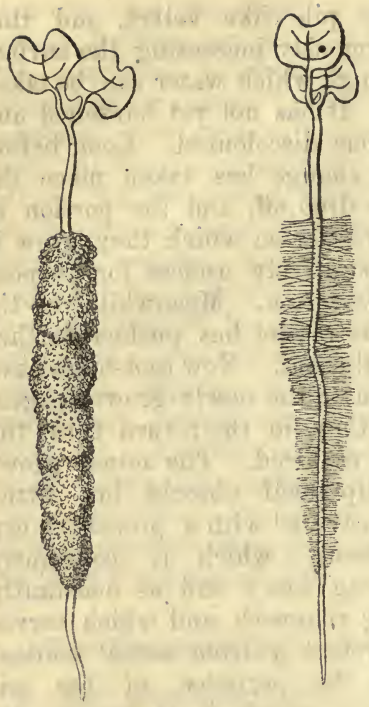


Figure 2.

round their base and with but few root-branches projecting below, cannot immediately take anything from the soil when planted in a new spot? Most certainly they cannot. The first effort of life after replanting is to throw out new root-fibres, each with its protective cap to explore and forage among the fresh soil. As they elongate, absorptive hairs cover the space of a few inches behind the cap and begin their function, pouring the fluid taken up into the tissues of the root. As the lengthening proceeds, the hindmost hairs die off in a few days just in proportion as new ones arise behind the apex. Thus it appears that the part of the root which absorbs is perpetually moving forward and coming in contact with unexhausted particles of soil, instead of lying inactive among material which it has worked out. The root-hairs cling tenaciously to the particles they touch, and as it were mould themselves on them. Their moist surface is capable of dissolving traces of the mineral constituents therein, and the solution passes inward to the carrying system of the root. Having made ever so few new rootlets and having begun to absorb through the root-hairs upon them, the transplanted life of the tree is begun.

8. This knowledge should distinctly influence practical work in planting fruit trees. Extreme care in lifting and preservation of as much as possible of the small fibres of

Figure 2.—Rape seedlings showing root-hairs covered with soil, and the same washed clean.

Figure 3.

Figure 4.

the root will repay the trouble taken. You thereby give the tree less repairs to make good. Use the six-pronged fork in the up-take, and as much as possible avoid the knife-edge of the spade. The quick formation of new rootlets depends upon a certain congenial warmth of the soil, with the presence of sufficient and not too great moisture. Hence in the parts of the Colony where, owing to altitude, the winter is severe, it is bad policy to transplant in early winter under the idea that the roots get hold of the ground before they make their spring start. Near the coast, where one may in winter have many consecutive days of mild weather, the root-system of trees so treated may begin to develop. But it is certain to be checked by

Figure 3.—Active and inactive zone of root of wheat-plant.
Figure 4.—Tip of a root-hair covered with particles of soil, greatly magnified.

the first cold spell, and on the whole such winter-planting is risky, and the losses greater than the gains. It is better to follow the method necessary at higher altitudes and with severer seasons, that is, spring-planting in soil which is daily becoming warmer under the increasing power of the sun. This is more conformable to the physiological life of the plant, and ensures its not receiving an injurious check.

With this knowledge the coarse method of chopping young transplants out with a spade so that they have only a few black ragged stumps left in lieu of roots will never be permitted. Such transplants if set in the ground must begin life by callusing the many wounds in the wood-tissue of their stumps, and then sending out rootlets from this callus-layer, *just as if they were cuttings set in to strike.* They have not even the chance that ordinary cuttings get, for the trunk and its numerous buds make immense demands upon the infant rootlets, far more than they can satisfy. And thus the miserable thing languishes, makes the poorest of growth above, and gets thrown back a season or perhaps more, merely for want of reasonable care in the up-take.

9. In a tree planted in well tilled, well drained, well opened soil, the advance of the root-tips is continuous till the limit of the tree's requirements is reached. In general one may say that the expanse of the foliage of a fruit tree gives a tolerably accurate measure of the expansion of the root-system under ground, but obviously the feeding-ground of the roots is not close to the trunk, but in a circle, whose radius is never less than half the height of the tree when matured. Whoever is aware of this phenomenon of a steady advance in the roots will go dead against the mischievous custom of applying irrigation-water and manure in a sort of hollow dug round the base of the trunk. Nor will he be a consenting party to the habit of planting trees in holes cut in an impervious clayey soil which has never been trenched. The normal advance of the root-system is stopped by the impenetrable walls of the pit, and the tree becomes unhealthy and shortlived, in spite of doses of manure and unlimited irrigation.

10. The relation of the root to the soil both as to mechanical condition, water-content and chemical con-

stituents will be treated hereafter. These paragraphs give the most important facts as to structure and growth by which the fruit grower has to guide his practice.

The Soil-constituents of Plant-food.

11. We have now to consider what substances form the food of plants, and which of them the soil must contain in order to supply their wants. When the wood of a tree is burned slowly with very small access of air there results a mass of charcoal or carbon. All the moisture and a little of the carbon originally in the wood-substance have been driven off like gas by the heat. Whence did the carbon come? Wholly and entirely from the atmosphere, which contains a variable amount, from $3\frac{1}{2}$ to 6 measures, of carbonic acid gas in every 10,000 of air. The foliage absorbs this carbon-containing gas, and turns the carbon to account in building up the tree's tissues. Let us suppose the log of charcoal is allowed to burn slowly away. All the carbon passes into the atmosphere again, being reconverted into carbonic acid gas. But there is left behind a small quantity of ash of a mineral nature. This handful of ash is the sum total of what the tree has drawn out of the soil in a dissolved state by means of its root-hairs, and without which constituents it could not have maintained a healthy life. If we analyse this ash we shall clearly get to know what substances a soil *must* contain in order to be fruitful, and what earth-elements go to make up the food of plants, independently of those contained in the essential air and water. They are as follows:—Nitrogen, sulphur, phosphorus, potassium, calcium, magnesium, iron, perhaps also chlorine. Of course, very small quantities are required, but they cannot be omitted. Plant life cannot go on continuously without a sufficient proportion of each one. Two other substances are always present, viz., sodium and silica, but they are not essential for healthy growth. Alumina, the base of clay, is also very widely diffused in most soils, but is not taken up by plants.

Nitrogen is presented in the form of ammonia and nitrates, and it seems probable that the ammonia is decomposed and converted into nitrates before absorption takes place. Not only is this element added to the soil by

manuring, but it has been demonstrated that the vast number of bacteria existing in the superficial layers of earth are perpetually acting on the atmospheric nitrogen and converting it to the purposes of the soil.

Sulphur is present as sulphates, like gypsum, which is sulphate of lime; and to a varying extent this element appears in animal manure.

Phosphorus occurs in bone-earth, which is phosphate of lime, and in guano. In the majority of our Cape soils it forms a mere trace, and its practical absence is one of the severest drawbacks we have to contend against both in cultures and the raising of stock.

Potassium is proportionately abundant in such Cape soils as are derived from the weathering down of granite; in others the amount is much less. It occurs as potassium nitrate and chloride in many manures, and may conveniently be applied artificially.

Calcium, the base of lime, acts in plant tissues chiefly as a carrier of sulphur-elements. When this work has been effected, it is comparatively useless to the plant, and is stowed away as a refuse material in the form of minute crystals of oxalate of lime in the older cells. We shall presently see that other important uses of lime relate to the mechanical constitution of the soil, upon which it has a signal effect.

Magnesium and iron both assist in stimulating the function of the chlorophyll or green matter of the leaf-cells. Plants grown without those elements become pale, sickly and yellowish. The addition of a trace of iron and magnesium salts immediately fetches up the normal healthy green appearance.

These statements are not theories or fancy views. They are drawn from rigorously conducted experiments in what are termed water-cultures, and it is impossible to traverse the conclusions to which they lead.

Respiration of Active Roots dependent on the Mechanical Condition of the Soil.

12. It cannot be too strongly impressed upon the cultivator that the roots of trees are not passive occupiers of the

ground, but have vital functions to perform which require the soil to be presented to them in a suitable mechanical condition. *They have to respire.* If the soil around them be so compact as to exclude air, or if it be drenched with water so as to drive the air out of its interstices and keep it out, the roots will infallibly die. In fact they can no more do without the small quantity of air they need than animals can do without the enormous supplies necessary to their more active respiration. The difference is one of degree only. The respiratory process is the same, consisting in the intake of atmospheric oxygen, its use to oxidize carbon compounds, and the subsequent output of carbonic acid. But because vegetable respiration, even from the leaves, is very sluggish, and masked from observation by the much more active work of assimilating carbon to build up the tissues, it is apt to be overlooked. And from this ignoring of a vital necessity spring some of the worst errors in cultural practice. We have enumerated certain mineral soil-constituents which must be present amidst the vast bulk of earth the planter has to deal with. It follows from the above that besides these, and in far greater bulk, there must be present *air* and *water*. The only way in which these two elements, a gas and a fluid, can be secured for the service of the roots is by breaking up the soil into a more or less powdery, porous, open condition by mechanical means. In the interstices of the separated particles of earth there enters an abundant modicum of air, nearly equal in cubic measurement to the bulk of the solid matter of the soil. One may almost predict the degree of success of any crop by the degree to which atmospheric air has been mixed up with the earth it is to grow in. The traditions of agriculture unconsciously point to the same truth. To till land is to mix the top stratum with air. Coarse ploughing of wet lands is leaving the great slab-like clods lying loose to dry out their water and absorb air instead. Harrowing among other ends, mixes air very completely with the loose tilth. But the most thorough and effective addition of this necessary ingredient is obtained by the process of *trenching*. By trenching almost every cubic inch of the soil is dissociated, large cavities full of air are left

open among the loosely thrown upcast, and although these diminish a good deal by pressure of the superabundant material, yet the air they contained forces its way into the microscopic interstices between particles far smaller than grains of sand.

So much for the air-supply demanded by the root respiration. Let us consider the water supply. It is unfortunately the current belief that trees must have water given to them much in the same way as one waters a horse. Either whole bucketsful are poured in at the base of the trunk, or a stream is turned on to flood its surroundings. This is in direct opposition to the natural way trees take up their water supply. "It is characteristic of the mode of life of land-plants that they only flourish, as a rule, when their roots are evenly distributed throughout a soil that is relatively dry, and only partially flooded with water."* The practice of agriculture bears testimony to this fact in that damp low-lying lands are made highly fertile by an adequate drainage which renders them relatively dry. The culture of plants in greenhouses teaches that land plants rooted in pots very easily perish if they are watered too often, and one of the first lessons a garden apprentice receives is "to keep his watering can quiet." Land plants and particularly trees, carry on their root-functions continuously only when the soil surrounding them is relatively poor in water. A complete saturation must be very brief and soon relieved by draining away, or else it acts injuriously.

12. Let us consider how the enormous losses of water by daily transpiration from the leaves are made good by imbibition from soil, not wet, but only just perceptibly moist to the touch, and therefore in the best possible condition for sustaining healthy root-growth. Every minute particle of earth, even down to those too small for distinct vision, is enveloped in a thin film of adherent water held fast by surface attraction, almost as if it had been dipped in water and brought out wet. Where particles by reason of their angular shape happen to fit closely together, the attractions combine to hold a thicker watery layer. The remaining

* Sachs. Vorlesungen, *XV.* Engl. Transl. p. 265.

interstices are filled with air. Among these surface-wetted particles the root-hairs make their way, clinging tightly to

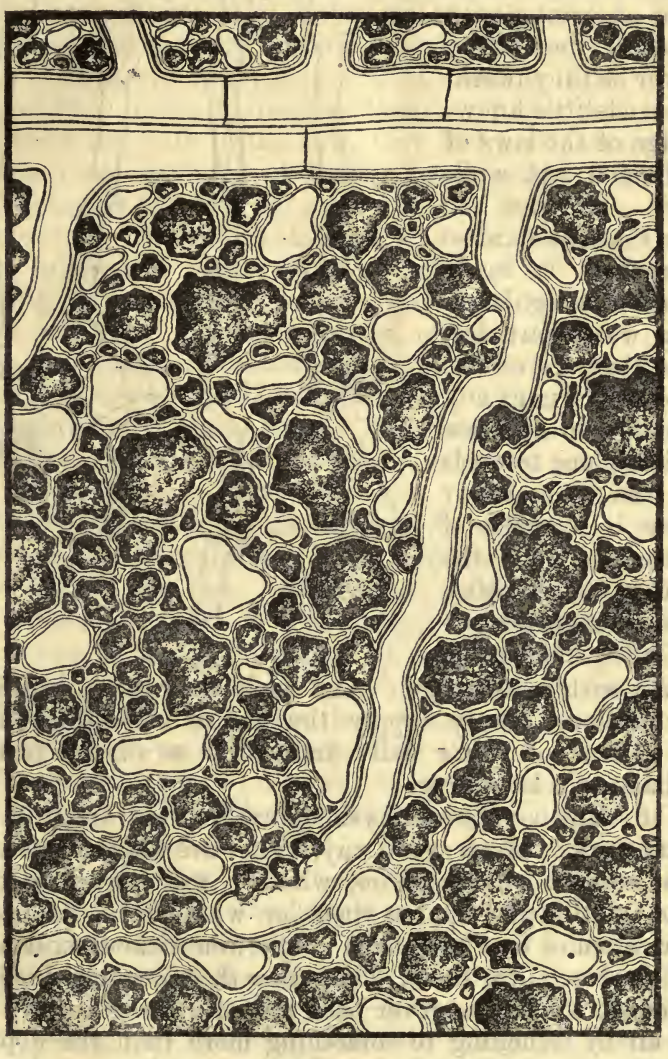


Figure 5.

Figure 5.—Diagrammatic representation of the relations of the root-hair to air and water in the soil. The angular bodies are earth-particles sheathed with a surface-film of water. The root-hair descending from the root has a similar water-film upon it. Larger portions of water fill in the interstitial angles. The numerous blank spaces, similarly film-encircled, are portions of air distributed among the mass.—(From *Sachs*).

them with their porous cell wall, and absorbing such part of the watery layer as they touch. It needs little knowledge of the laws of diffusion and capillary attraction to see that the fluid so absorbed is made good by neighbouring water-particles, and that, given absorption at any point, an indraw takes place towards it. Every root-hair then is a centre of attraction to the water constituting the moisture-layer of all particles of earth within its range. And such absorptions, multiplied by millions, amply supply the almost incredible number of gallons of water daily transpired as vapour from the foliage of a large tree.

Figure 6.

13. But have these physiological facts any value in practical work? Much every way. They are what all successful tree culture is founded on, whether the workman knows and intelligently applies them, or whether he follows empirical rules that have been taught him without explanation of the reason for them. They show that compact, unaërated ground, which has never been mixed up with its own bulk of air by trenching to something more than the depth to which average roots penetrate, is not fit to grow trees. They show that the unfitness is only locally and partially rectified by digging out a two or three foot hole and making its earth contents as loose, aërated and open as the

Figure 6.—Absorptive tips of root-hairs, highly magnified.

whole orchard area ought to be. They show that when the advancing root-system of the tree has got through the poor thirsty dozen cubic feet of decent soil in its hole, it reaches the compact earth walls around it and progress is barred. If the feeding tips force their way in, there is little or no air, and they cease to respire freely. If they coil back upon the loose earth in the hole, they find it impoverished, for it is their leavings of former years. Of course the trees' demands are just as great as ever, but the stifled rootlets in the hard untrenched soil, and the famished ones in the hole-space cannot supply them. Then follows a lingering period of death, more or less drawn out according to circumstances. The young wood of the year dies back in the dry summer, making the well-known appearance atop that gardeners have likened to stag's horns. The leaves drop before their natural time. The fruit, if any, is small, dry and worthless. Branch after branch dries out, smitten with sheer famine, till the end comes. *This fatal error of insufficiently trenching up land meant for orchard purposes, and relying on the contents of small artificial pits, is one of the two reasons why Cape fruit trees are so short-lived.* The other reason is not far to seek, being dependent upon the same series of facts regarding the mechanical condition of the soil. Let us look back at the diagram representing a feeding root-hair as it feels its way among the congenial mixture of earth-particles, water-films and air. Carry the idea it represents over to a Cape fruit-tree planted in a hole the size of a 3 x 3 x 3 feet packing case, and surrounded by compact unworked ground. It is our turn to "have the water." Well, we run it on the depression round the tree. In half-an-hour the hollow is full. Bubbles of air keep pointing up in the pool. Now pray call to mind the diagram representing the conditions demanded for healthy root-life. Look at the large air-spaces. Then consider that by filling that three-foot hole with water till it stands above like a pool every bubble of the vital air has been drowned out and forced to ascend and escape at the surface. What should be full of air is now full of water. The roots are completely immersed and their respiration is stopped. Fortunately, this state of things does not last long. Even the most compact clays slowly absorb water,

and the destructive surplus percolates away through their substance, relieving the asphyxiated roots, and making way for air to enter from the surface. Such ill-judged contradiction of the laws of root-life therefore does not at once kill the trees. But the practice of more or less completely asphyxiating them by drowning several times a week is by far the commonest cause of the casting of fruit, the dying out of the special young shoots of the year, and the general short space of life allotted to a Cape orchard in other than sandy open ground.

Means of ensuring the proper mechanical condition of the Soil.

14. We will assume that the cultivator has the conviction firmly established in his mind that success depends upon the degree of completeness with which he can make his soil resemble the mechanical conditions present in a sponge. The foundation of his practice must be the maxim that trees do not grow in earth alone, but in a mixture of earth, air and water. That mixture is soil, if the word is properly understood; and his first care is to convert the earth of his erven into soil. The difference between the two is something like that which exists between the rudest barbarism and a high civilization. Little or nothing is possible to the former; everything is possible to the latter.

Selection of a Locality.

15. No great reflection will be needed to show that the proper selection of a locality for an orchard may very materially diminish the amount of labour and expense requisite to produce the mechanical conditions so much to be desired. Unless absolutely shut up to a definite acreage without a chance of skilled selection, no person would attempt to make an orchard upon a compact clay, or in a place where the level of the ground relatively to other properties rendered it the recipient of surplus water from above. It is essential, even when a man can choose his ground, and receives no seepage from his neighbours, that there be the freest possible outlet for his own drainage, whether of rain water or that which he supplies by irrigation. Yet one

frequently sees the fruit-tree patch located in a mere sump, where in winter the water will weep into a hole made but one spit deep,* and that without the least effort being made to lower the water-table permanently by drainage, so that it shall never reach the level of the average depth of the roots. The locality then should be on a gentle slope to ensure the best water conditions, so as to fulfil the proverbial saying—"soon on and soon off," which concentrates in itself a good deal of gardening wisdom. In another place other conditions of selection, particularly that of aspect and shelter will be dealt with.

16. By far the most thorough and satisfactory method of inducing the desirable spongy condition of the soil, is the simple yet expensive and laborious operation of trenching. Much has been done by the implement-maker to effectively break up raw earth and let vital air into it; but for the most part these mechanical appliances, however successfully they deal with such tilth as may suit cereals or even root crops, do not go deep enough for the best orchard preparation, except at an expense for steam-gear which brings their work pretty close to the cost of the much more effective hand labour of trenching. At least this is the case with the imported appliances available here. The great thing to be wished for in this regard is that the fruit-grower shall deal as handsomely by his orchard as he has, through long custom and prescription, habitually dealt by his vineyard. The depth to which the trenching should penetrate depends greatly upon the nature of the soil. It must be remembered that if in clay-land it penetrates only two feet, the drainage of the winter rains and much of the irrigation-water in spring and summer will creep along that two-feet level. The deeper therefore, under such circumstances, the cultivator pushes such trenching, by so much does he lower the water-table, and gives his trees immunity against water-logging of their roots. Should the soil be sandy and naturally open, rapidly relieving itself of surplus water by percolation downwards as well as along its natural slope, the necessity for deep trenching is not so absolute, and limits itself more particularly to the aëration of the

* In gardener's English a *spit* is the amount of earth taken out by one effort of the spade.

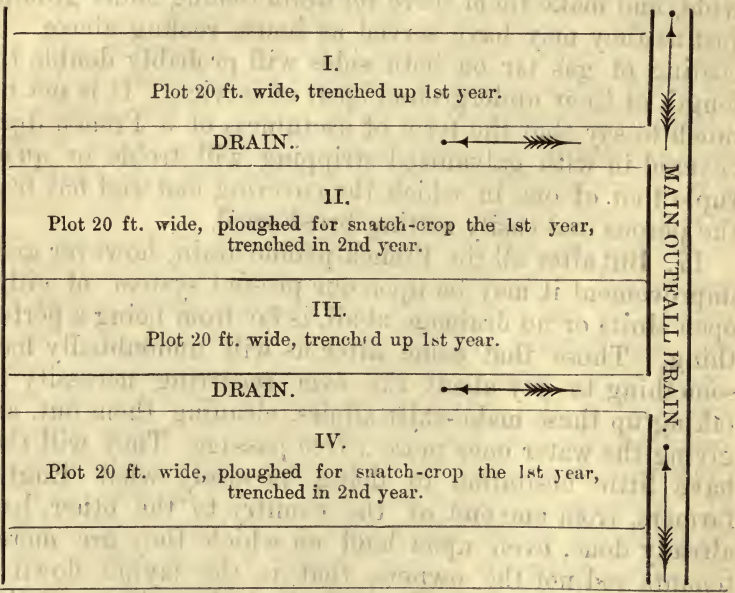
soil. Under any circumstances however a sufficient number of well-planned French drains should be taken out down the main slope in every part of their course, and should descend into the subsoil a little lower than the depth to which the trenching has been regulated. This excellent system, perhaps the only one that will for a long time be in use in this country, consists of a V-shaped trench cut down into the subsoil straight along the main slope of the land. The greatest care must be taken to leave the bottom of the trench unbroken, and in an exact plane. Clearly if its bottom wavers in the least the water will not get a free outflow, pools will form in its course, and much of the value of the drain will be lost. To one unaccustomed to earth-work, it would seem the simplest thing in the world to take out a drain, but it is really a skilled operation, and only a labourer who has practised it under a sharp foreman will carry out the true plane requisite for the bottom water-flow without many mistakes and repeated patchings. Remember that whenever the subsoil-floor of the drain has been taken out too deep, and has to be repaired and fetched into line by ramming material into it, you will have a soft place, where the water has a tendency to hang. It is therefore very good policy to employ for this task men who have had considerable practice, seeing that the work is better done, and more economically, because more rapidly executed. It is not necessary that the bottom of the trench should be of the full width of an ordinary spade. Draining spades for the special purpose of finishing off such work are made barely six inches wide, and there is economy in their use. The usual custom is to fill the channel with rounded river pebbles, or similar rubble, to a depth of about nine inches or a little more. Angular fragments of stone are to be avoided if possible, as they do not give nearly such large interstices, and they are much more apt to cause clogging and stoppage. Upon the top of this pebble-bed it is customary to put a layer of brushwood or *takkies*, well battened down. The only object of so compressing the brushwood is to work the layer together and prevent filling from soil dropping through it into the pebble-bed. Some time in the near future when cultivators have found out that a little capital buried under the surface of the soil, which gives

them their returns, is a profitable outlay, we shall do something better than cover in our French drains with such poor stuff as brushwood, which in the nature of things cannot maintain its resistance for more than a very few seasons. Ultimately it must moulder away and help to fill the openings in the pebble layer. The better method, and the one which will ultimately be followed by progressive men, will be to buy up galvanized iron sheets that have served their purpose above ground, cut them into strips about a foot wide, and make them serve for drain roofing under ground, just as they may have served as house roofing above. A coating of gas tar on both sides will probably double the length of their underground spell of service. It is not too much to say that the term of usefulness of a French drain covered in with galvanized stripping will treble or quadruple that of one in which the covering material has been the porous and easily rotting brushwood.

17. But after all the French-pebble drain, however great improvement it may be upon our present system of either open sluits or no drainage at all, is far from being a perfect thing. Those that come after us will undoubtedly have something to say about the ever recurring necessity for taking up these make-shift affairs, cleaning them out, and giving the water once more a free passage. They will then have little hesitation in doing precisely what English farmers, from one end of the country to the other, have already done, even upon land on which they are merely tenants and not the owners, that is, the laying down of permanent drain-tiles. Properly laid, these drains outlast several generations of farmers, carry off the water with three or four times the certainty and swiftness of the French drain, and never clog up. There is at least one example on the Cape Peninsula of work of this class, and by its means an immense acreage of worthless drowned land, on which cattle could not venture without risk, has been converted into one of the most productive market-farms to be seen in the country.

18. The gospel of trenching and draining is a hard one; it means considerable outlay long before a return can be expected, and the customs of the country in everything connected with land seem to have been based upon a

general theory of no capital and snatch-crops. It is not thus that fruit-farming is made a commercial success otherwheres. A certain sort of success, although decidedly not the best, may be attained by spreading the total expenditure in trenching over several years. Thus an orchard of say 20 acres,* upon a gentle slope, may be trenched up in strips of land straight down the incline with a drain alongside each strip. For example let the trenched piece No. I be laid off 20 feet wide and the drain to follow.



The next plot of 20 feet is ploughed up the first year and used for a snatch-crop. In the second year, it is trenched exactly as was No. I. Next to this lies the third plot trenched up at the same time as No. I. Then comes a second line of drain, followed by plot No IV., treated as was No. II. for a first year's snatch-crop and a second year's trenching. And thus the alternations go on over the whole area. By this means about half the cost of complete trenching an acre to be devoted to fruit culture would be distributed over perhaps two or three years. The great thing however to be enforced is that a scamping treatment

* At present there is scarcely any such thing in this country; what we call rchards, a Californian or Florida grower would call a "fruit-garden."

of the ground, which would be avoided by every good wine-farmer if proposed to be applied to a vineyard, is for the same reasons and in the same measure, not good enough for fruit-trees. At least let the peaches and apricots, the oranges, apples and pears, get the same chance dealt out to them which we accord to the vine.

Manuring of Orchard Ground.

19. During the time of trenching is the best time for manuring the ground if its natural poorness requires that assistance. The old method of putting a basket of manure in a hole near the foot of the tree will not do at all. But as the strata of spaded earth are taking their new position, a labourer is told off with the six-pronged fork to scatter the manure between their layers. By this means the manurial ingredients are diffused pretty evenly throughout the whole mass. If your supply runs short, let the third foot of the depth go without the dung, and give what you have to the upper two feet. With a still shorter supply you will have to be very sparing. You will find it more thrifty to have the top spit of the ground left very rough. Then scatter what manure you have over the ragged surface, and turn it in when you finally level it down to a cultivable smoothness. Practically this amounts to a top-dressing only. Where you are working with a clayey soil, manure that is not particularly rich in animal matter, but contains much of incompletely decomposed straw, finds its best use in assisting aëration and preventing the packing together of the soil.

Do not suppose that in such soils as fall to the lot of the average fruit grower at the Cape, there is necessarily a call for much manuring. We are very apt to look upon manuring as a sort of cure-all, which with excessive irrigation is to save us the labour of trenching up the soil, pruning the trees to fruiting condition, and looking well after them generally. Have we not given them plenty of rich compost? Then why don't they bear satisfactorily? The fact is the majority of fairly fertile soils that have been industriously cultivated will suit fruit trees without other manure than a light top dressing, for years, if only

they get the inevitable and necessary opening-up by trenching. Heavy manuring is the cultural need of annual crops which have to spring up, blossom and seed at racing pace, to get through with their short lives within the year. Your fruit trees do not take life so fast, and they therefore do not require the stimulus appropriate to cereals and root-crops whose work is done in five or six months. The parallel of the vine, which takes an enormous manure supply every second or third season, does not run exactly on all fours with the apple, peach and pear. These trees and their like are not every year cut back to mere skeletons of their former selves, and have not to make a forest of bearing wood betimes to carry the great crop of fruit they proffer to the farmer. The vine's annual output is excessive compared with that of ordinary fruit trees, especially when you consider how small an average vine is and how much larger an orchard tree. But common sense will show that the more deliberate growth and more limited fruiting of the orchard calls for less manurial enrichment.

Laying Out and Planting.

20. Let us suppose that by the means indicated, either the whole area of the orchard or the alternating 20-foot strips of which we have spoken, have been thoroughly broken up and converted into mellow, well-aërated soil. The drains have also been laid out and their trenches filled in. On no account will the judicious cultivator submit to have an open drain left upon land that he cares for. It is a waste of so much space. Its side-slopes inevitably become gardens of weeds and harbours for pests innumerable. The flume that brings the irrigation-water to the land must perhaps be open, and the evils of that openness must be put up with and kept in check by constant care. Some day, it is to be hoped in the near future, we shall either pave our water-flume with shale or some other material, the rejected wane-planks of the saw-pit, or possibly the same sort of galvanized iron that is doing duty in our French drains. We shall by this means get rid of the perpetual troubles arising from the damage to the banks by tread of feet and the enormous loss that accrues through soakage.

21. The next consideration is the laying out and locating the places for the trees. A few words may be given as to the surveying devices which go to make up correct laying-out. The simple method of staking two corners and putting in a few sticks for sighting scarcely needs description. A correct line down one side of the area is thus obtained. The difficulty is to lay off a true right-angle for the breadth-measure. The simplest way of doing this is to measure off 80 feet along the true side with a tape line and stake the point obtained. Then from the starting point measure along the other side 63 feet, drawing the tape as nearly as possible at a right angle, judging by the eye, and put in a mark. Now, if the angle so made is a true right angle, you will find that the diagonal or cross-line measure, from mark to mark and completing the triangle will give you exactly 100 feet. If it is less, the 60-feet mark has been taken too far in; if it is more, then you have splayed it too far out, and in either case correction must be made until the 100-feet diagonal measures up correctly. Having thus got your true corner, the lines can be continued by the common method of sighting with upright sticks. Along the whole area parallel lines can be set out with great accuracy by measuring off the same distance along the two opposite sides, staking the points and putting up sighting-sticks between them. Upon these lines, at given distances, the tree-planting marks are to be placed. In this work as in everything connected with measurements, it is best to do the whole job at once without a break. Doing the task of setting-out piecemeal invariably leads to irregular and unsatisfactory results.

22. The next point to be considered is one on which there are almost as many opinions as there are planters. It is the question of how many trees to put on an acre of ground, or rather, how near may you plant fruit-trees and get a good crop off them. The question however should not be "How close can I stick my trees without being considered mean to them?" but rather "What distance apart would be best for their healthy growth?" The tendency is naturally to put them far too near each other, because they come to the ground mere yearlings from their date of grafting, and are so small that it requires the planter to be next

door to a prophet and have a prophet's imagination to enable him to figure to himself the size to which they will grow in five or six years' time. The best check to a niggardly appropriation of space is to keep in mind that whatever interval you allow, the foliage-head of two adjoining trees must necessarily go halves in it; and what is true of the branching head is equally true of the branching roots, which just as certainly share the feeding-ground between them. The smallest distance which can be allowed between tree and tree is 20 feet apart. Set squarely, this will give 109 trees to a square of exactly one acre, and is the smallest allotment that can be allowed for standard trees if they are to do any good. The more liberal allotment of 22 feet apart, giving 90 per square acre will probably pay better in the long run. In other countries the result of experience is all on the side of generous allotment of space, and new orchards are being set out with wider distances year by year. For dwarf trees, such as are decidedly best fitted to withstand the violent winds of this country, and which require much less screening-shelter, a distance of 18 feet apart will be found sufficient. It gives 134 trees to the aforesaid square of one acre. If you skimp the distance and think to advantage yourself by putting such trees 14 feet apart with a total of 222, or 10 feet apart with 435 to the square, you will find yourself puzzled to get your plough or even your cultivator to turn between them when you are working the tilth to eradicate weeds. Therefore hold fast to the minimum of 18 feet apart even for dwarfs. In laying out these distances along the parallel lines that you have set out with your sighting-sticks, be sure to arrange so that the rows shall, as it were, break joint; any one tree of a row being opposite to a blank space in the next row. The device is of universal use in vineyards. The underground feeding space of the roots is thereby more evenly divided, and the effect of high wind very much diminished, because there is so much less opportunity for the wind, as the foresters say, "getting into the wood." If the boundaries of your ground are already laid out and incapable of alteration, you will have to be content with thus much done in foresight of danger from the wind. You can do no more except you plant a

wind-screen of Lombardy poplars, to stand up in the eye of the wind and break it up into air-spray. It is astonishing what an amount of gusty weather these quincunxes or or sets of five (for into that pattern they naturally run), will bear up against without damage, because each tree is more or less a safeguard to two of its neighbours down the wind. But supposing that you can take your pick of land previously unenclosed, then bethink you so to place your orchard as to hang diagonally across the wind-run, not with a hard line at right angles to it. Yet such common sense is often forgotten, and the line is drawn straight across the brute force of the prevailing winds, instead of half coaxing, half slipping it aside.

23. Everybody thinks he can plant a tree, just as everyone believes he can poke a fire, make a speech, or drive a buggy—till he has tried. It is easy to plant a tree wrong and make an utter mess of it, but we want a more excellent way. Even supposing that your ground is well aërated by trenching, it is quite worth while to have all the holes for your graftlings dug out before you begin. You get the run of them better, you can correct the lines of setting, and the stuff thrown out in the upcast is all the better for being exposed to the sun and air. Particularly is this to be recommended when the loam you are planting in is just a little too clayey. Let us suppose you have purchased your graftlings by selection from a first class nurseryman, and with all due care to the nature of the stocks upon which they have been worked, the pedigree sorts they represent, and the proportions of the kinds according to the fruit-business you intend to run. As soon as they arrive, have the parcels opened without an hour's delay, and heel them in properly at once. Do this even if the holes are ready and you mean to plant next morning at daylight. A score of things may happen to postpone your work; besides, the labour is very trifling. You dig a furrow with one side specially slanting, in the lightest and most open soil that you can command, taking care that it is moist, or rather, damp without being wet, and not exposed to the sweltering sunshine. Along the slope of this you lay your trees one by one from left to right, carefully sticking in a name-label at

the point where each sort runs out. When you come to the last plant in each bundle shovel the fine earth gently over the roots, a little at a time, so that it shall wriggle well in among them, and it will be no harm should the earth cover one half or even more of the stem. Suppose the trees have come from far, you may dip the bundle in water to wet the contents thoroughly, and then proceed as before. If they have been very badly used in transit, and the bark at the top looks at all shrivelled, you may give them a somewhat longer bath, but not much. In such case it is far better to rake the fresh earth-slope back a little and cover the young trees with a thin cool upthrow of earth. Nine times out of ten a day and a night of such treatment will make them look as plump as ever. Nor is this at all wonderful. Every green part of a tree, not excepting the stem, while it is young and still keeps its green colour, transpires actively. Hence the temporary wilting is due to the young bark having thrown off a considerable quantity of moisture which cannot be replenished from the severed roots. The cool, moist earth round the green stems enables them to recover themselves and get back that moisture they have lost.

24. Be very careful that no mixing of the sorts occurs through the officious helpfulness of the labourers. In fact, unless the number is very large, it is best for one person only to do the heeling in, and thus secure accuracy in labelling and the avoidance of mixture. It is altogether aggravating to find an odd peach or apple breaking the symmetry of a line intended to carry fruit all of one kind. Remember also that it is no business of the nurseryman to cut back your graftlings to what he may choose to consider a standard size. In fact this is done by most nurserymen merely to save themselves a little trouble in packing, and to make what they are pleased to term a neater bale. Insist on having the trees sent you precisely as they were lifted from the ground in the nursery-bed with the digging-fork. The subsequent shaping of the tree is your work, and must be deferred until you have got it set in its place in your orchard.

25. The actual planting of the tree is about as simple as a thing can be. Yet often curious mistakes are made. It

is best for two men to divide the job. A little of the upcast earth is thrown upon the bottom of the hole, and the soil is then loosened up by a chopping action of the spade. More earth is added until it is found by trial that the graftling tree will sit easily on the loose content and the collar stand a little higher than the level of the surface in which the hole has been dug. The contraction of the filling will take up that slight surplus and leave it true. The roots are then carefully looked over, all broken ends are cut off with a sharp sloping cut facing downwards, and the fibres distributed evenly upon the cushion of soil in the hole. They must be divided fairly around the circumference of which the stem is the centre. Little by little the attendant shovels in small quantities of loose earth, and this is packed and worked in by the planter's hands, so that close contact, and above all the absence of hollows, may be ensured. At the same time the planter looks to the accurate setting of the tree, both for line and uprightness. Then both men shovel in the soil to the surface. Note that the firming of the soil immediately among and over the roots is done with the planter's hands. Neither immediately on the roots nor even on the surface soil is there any need for the ill-considered tramping and jumping on the in-throw which is so often practised. The object should be to ensure for the root-system a firm yet gentle contact with the moist aërated spongy soil. The prevalent ramming-in of the earth may be useful in setting a post, but we are dealing with a living organism from which we expect delicate rootlets to grow, and for which we desire to prepare a suitable feeding ground. Some planters fill the hole carefully up to the brim, and then gently press in the whole mass with the foot, subsequently filling in the space so gained with more soil to level up once more. Good work may be done thus, but there is no method more reasonable or more successful than the manipulation of the first additions of soil around the roots with the hands, to ensure the proper degree of closeness and firmness without losing the open sponginess of soil which is all important to preserve.

26. Then, even if rain is falling at the time, the final operation must be watering. From a gallon and a half to

two gallons of water, according to the size of the hole, is to be gently and slowly watered in from the rose of a can. It will not do to slush it in from a bucket. The effect desired is to settle the particles of soil finally in their places, and establish an average of equal pressure around the root. A sudden dash of water will convert the top stratum into mud, and this will dry slowly into an impervious caked surface, whereas after watering, the soil round the little tree should be just as open and porous as before.

27. If you can choose your time, let the planting be done in cool overcast weather, without either bright sunshine or much wind. The caution given as to the vital transpiration taking place from all green parts, even the stem of young plants so long as it has not acquired its mature brown corky layer, applies here. In a few days, if the soil be not inhospitably cold, your tree will have begun to callus the cut portions of the roots with new tissue, and new white feeding fibres will spring from this layer and from the uninjured branch-roots, each sending up watery food-material into the stem. The little tree has caught on in its new home.

28. The Cape is a country where some things are killed with mistaken kindness. On no account follow the common custom of bottoming every tree-planting hole with a shovelful of manure, under the idea that the tree is getting thereby a special mark of attention. Independent of the fact that "manure" too often means raw stable dung, fermenting fast and reeking with ammonia, there is this to be considered, that manurial ingredients can only be satisfactorily taken up by those fine root-hairs we described, when presented in a very diluted state by the help of water. And, moreover, the fermentation and decay of this organic matter gives off a large quantity of carbonic acid gas, filling up the interstices of the soil and driving upwards the atmospheric air which ought to fill them. It is fortunate that gases have a wonderful power of diffusion, and dilute themselves away with great rapidity. Were it not for this, the custom of bottoming tree-pits with fermenting dung would have been dropped long ago as a sure means of asphyxiating the roots. If the orchard has been prepared properly in average fertile soil,

or, if in one somewhat poorer, a little old well-rotted manure has been added during the trenching, there is not the least need for these kindnesses. As a general statement it may be said that orchard manuring is best done by top-dressing, turning the material into the upper tilth to be carried slowly by solution down to the level of the roots. As each tree is brought into place, a note of its position and name is entered in the foreman's book, something thus. Say it is peaches we are handling—"Row A, 1-10, Royal George; 11-20, Grosse Mignon," and so on. From these data taken at the moment, the chart of the orchard is compiled, so that there may be no reliance either upon a vague remembrance or upon the salesman's labels, which wind and rain will soon render illegible. In this plan every row is carefully plotted, and the individual trees have their names entered in where they stand. By preference make the plan upon a piece of the transparent tracing linen used by surveyors. It does not readily tear, as all paper will do, unless mounted on calico or other tissue. Do not fold it square-wise, lest it rub through at the kinks with much use, but rather fold it exactly like a window-blind on a light wooden roller. It is not at all superfluous to make the plan out in duplicate, so that in case of accidents, fire or what not destroying the first copy, you will not be utterly at sea as to the names and whereabouts of your fruit-sorts. It may well be said that next to our habit of letting seedlings run on to fruit, neglect of this simple precaution is perhaps the chief cause of the absence of any general knowledge of fruit-sorts and the qualities which distinguish them one from another. We have to acquire such an amount of what is rather grandiloquently called "pomology," in order to hold our own against foreign growers who know fruit-sorts at sight as they know their dogs and horses. It is not a good plan to stake your young plants in the usual way with a support driven in among the roots you have so carefully established. Much mischief is often done by this ill-considered operation. Yearling trees when headed back will almost always be so inconsiderable in bulk as to afford no opposition to the wind, and this is an additional reason for beginning a plantation with them instead of with two to three year

olds. In all cases where staking is absolutely necessary, as in large transplants that have already been cut back in the nursery to form leaders, it is much the best plan to put in two stakes 14 to 15 inches distance from the tree, and tie it to a crossbar fastened horizontally from one to the other. But no experienced person would choose stuff of this sort. It is the beginner who buys his trees big. Yearlings have mostly at the end of one season got such firm hold of the ground with their roots that they have no need of artificial support, and are every way preferable.

29. As soon as the row of trees is in place, the planter, in accordance with his pre-arranged plan of future proceedings, shortens back every graftling to the definite height suited to its kind. Some cut back knee high, others allow a little more height. In every case the level must be as nearly as possible the same, and the section must be made aslant, just above a bud, neither cramping it in nor leaving a peg of wood above it. If the cut slopes back too close behind the bud, leaving it as it were a projection on the upper end of the oval section, there will not be sap enough left to nourish it. Should a good inch or more project above it, that piece will assuredly dry up and die, probably bringing decay into the tissues of the stem below. It is difficult to get amateurs to see the necessity for this shortening back to a given height. It seems to be a wanton throwing away of so much good stem-growth, and they are apt to let the young trees run up like fishing-rods, unconscious of the covert derision with which the skilled gardener surveys their forest of sticks. It will presently be quite clear why yearling trees were previously recommended, and why shortening back is laid down as a necessity of the case.

30. And when this operation of cutting back is in hand, remember that you are dealing with tender young stuff, which has not yet formed a hard wood-cylinder within, or a corky bark without. On no account be tempted to use the convenient and rapid secateur. However cleverly made, with crescent-blades and a rolling pivot, the cut is never so clean and satisfactory as that of the ordinary pruning-knife fresh from the oilstone. The tender bark is

invariably somewhat bruised and the cambium-layer underneath crushed. A keen cut with the knife has none of this nipping action, but leaves the bark perfect and in close contact with the underlying wood right up to the line of section. No careful grower who has examined with a lens the rough clip of the secateur, and compared it with the clean section of the knife, will ever use the former rough and ready implement upon his young plantlings while in the infant stage, whatever he may do subsequently in coarser work. And yet another caution. It seems almost absurd to add—when cutting transplants back to the determined height, take care not to pull them loose from their seat in the soft earth with a jerking cut. Yet one sees this thoughtless trick done times without number. Hold the stem firmly with the left hand, while making the sloping cut discreetly with just enough force and no more to bring the edge through. So shall your care in planting not be stultified by thoughtlessness in the next operation.

31. We have pointed out that fruit tree culture is essentially a formative art. The trees we plant are not left to take their natural growth, but are compelled to follow the artificial conditions which long experience and observation have shown to make for the cultivator's advantage. The first of these interferences enforced upon the tree's life tends to shape it into some one of certain compact and convenient forms. In this country there is only one form of general application. The tree is worked into a more or less inverted cone, the main axis of growth being suppressed, and secondary branch-growths encouraged to spring outwards and upwards from the point of suppression or near it. Ultimately the tree presents an outline more or less completely Y-shaped, variations arising merely from the greater or less angle formed by the chief branches with the line of axis, and the amount of bearing wood allowed to develope inward and outward of the cone. The chief exception to this general plan is the orange and lemon series of fruit trees, where it is essential to their well-doing that the axis be not suppressed. But with other fruit trees, the inverted cone system should be almost universal. Just as our Cape vines are invariably pruned up *en gobelet*, to use the French vine-dresser's phrase, with a short centre stock and

four or five lateral radiating arms, so that method is carried out as far as possible in the orchard. And espalier, cordon and fan-trained trees are even more uncommon than vines grown on vineyard trellising of wood or wire. In this little pamphlet, no attempt will be made to detail the method of shaping trees in what are, as far as the Colony is concerned, merely fancy methods. It was not without reason, but with a wise prevision of the power of the Cape south-easter in destroying costly trellises that the Huguenot fathers of our viticulture abandoned the *cordon* and *échulas* of their less wind-swept home, and adhered to the less picturesque but far more suitable *gobelet* form, or as we might phrase it, the cup-shaped pattern.

32. The first step in shaping has already been taken when we headed back the graftlings as soon as planted. The buds on the remaining twelve or fourteen inches of stem will speedily begin to shoot out into leafy twigs. Seeing that all the carbo-hydrate food-material of the plant is elaborated in the leaves, whence it passes down to the stem and to the points where growth is going on, this early foliage is performing the function of a stomach, and it is not advisable to be anxious to cut these twigs out directly, saving only those afterwards required. It is an error to suppose that leafing exhausts the little tree. The extension of the feeding roots is materially assisted by the existence of leafage above. But when the growth has reached some five or six inches in length, the cultivator passes every tree in review, selects as future laterals, three, four or five of the shoots best placed for equal division of the space at command, and either completely suppresses all the other lower shoots, or pinches them out to a mere two inch spur. Practice differs on this point. Some like to make a clean stock at once, others, knowing that the bunchy leafage left helps the tree-growth, let it remain to shade the trunk which as yet is tender and liable to sun-scald. The chosen laterals make their growth right away to the end of the season.

33. During the dormant season succeeding, another step towards shaping the tree is taken. Each lateral is cut back to an outside bud, leaving about a foot of its length remaining. Gardeners of experience keep in mind their

knowledge of the special habit of this and that sort which they may be pruning. If the kind be one of spare and lanky growth, apt to make a thin hollow head, they will perhaps cut the laterals back to a bare six inches, and in this way secure a closer after-set of branches. A sort lavish of wood and hard to keep in bounds is left full long. This "counsel of perfection" can only be hinted at here, to show by an example how much observation and forethought go to make a good gardener. The average given, viz., one foot, will be found to cover average cases, and the reader must get his experience where every skilled man gets it, that is, by trial. Supposing that side shoots have been made on the part of the laterals left, they are to be cut back to the lowest or at the most the second bud from the base. Many, as in the case of the main stem, cut them away entirely; a practice not to be recommended.

34. The second season comes round. Each twelve inch lateral is allowed to make two sublaterals and no more. The others are pinched out as they appear all through the summer. In choosing the shoots for these and suppressing the rest, much more judgment is required than in the simple work of the first year. You have to consider what form will be given to the tree by the increase of this or that shoot you may elect to leave, and thus prophesy what your tree will be like ultimately. And unlike other prophets, you can force your predictions to come true. Leave all these sub-laterals of the second degree to grow their best throughout the summer following, unless they become too rampant altogether, and break away into side shoots to the weakening of their axial extension. The apricot has a precocious habit of this sort, and has to be kept in order by pinching in during the summer as may be necessary.

35. So matters proceed till the third winter pruning-season comes round. The tree has now got its Y-shaped profile pretty distinct, and the dullest observer can see it is being worked on a predeterminate plan. Do not let the tree give more than a sample of its produce, just to assure you it is the precise sort you planted it for, and that it agrees with the authoritative descriptions in Hogg's Manual and other pomological descriptive works. Thin such precocious bearing down to just enough for judgment; the fruit is rarely

equal in size or flavour to that of the crops you are to get if you wait. The pruning you have to do is exactly a repetition of last year's work, but a stage higher up in the tree. You had originally four branches. You allowed eight laterals to run, two from each of them. Now your set of eight is to be converted into sixteen by choice of the two best placed shoots on each. Pinch out the rest as before. Cut back to about eighteen inches those you preserve. And here a little judgment must be exercised.

36. Seeing that in this third series of reserved shoots we have advanced much higher up in the cone pattern we are shaping out, it is clear that the circumference of the pruned head of the tree will give now a very much larger circle than previously. The operator must therefore take care that he does not "prune to a hollow head," that is, cut the series all to outside buds, which will shoot outwards, enlarging the cone, and give little or no provision for filling the centre. Enough must be cut to side buds, or even inner ones, to provide against an open head. All that can be done in these verbal directions is to point out that cutting to outside buds tends to enlarge the cone and thin the head; cutting to inside buds will as certainly decrease it and thicken up the head. A judicious balance between the extremes must be made, and this result will give a well-formed Y-shaped tree whose centre is sufficiently dense without crowding, and whose arms are not so extravagantly splayed outwards as to make the junction whence they spring too weak to bear the leverage exerted by the limbs and their weight of fruit. Nor are they so much sloped as to interfere with your hand-cultivator or your barrow. Much may be learned by watching the practice of some wise old gardener, and if possible following the mental picture he has in his mind of what the tree is to be shaped up to, and observing how he makes the buds to which he cuts serve his purpose. Above all, the beginner must try for himself, after getting the principles of the art well into his mind. Undoubtedly he will make mistakes; but every mistake should be the very best lesson in *never making it again.*

37. It is scarcely necessary to add that there is nothing absolute in the number four taken as an example. Three

shoots only may be allowed to start from the yearling transplant, giving next season six sub-laterals, and these six will result in twelve. Custom and fancy have much to do with the number chosen, and the only thing that can be said is, that it is better to have too few than too many.

38. The result of the three years' shaping is to give a tree, not of its own wild natural habit, but of one of the shapes best fitted to turn the whole of its available powers into fruit production. The subjoined figure gives an idea of

the general type to be aimed at, and a careful study of the direction of the second and third series of shoots will show that the uniform distance apart of the branches forming the crown has been got by cutting after the manner here indicated. The subsequent yearly pruning is really little more than the maintenance of the artificial condition now reached, *plus* certain adaptations called for by the peculiar habits affected by this tree and that. Thus the peach, the apricot, the apple and the pear, each require a slightly

modified use of the knife, and this portion of the art—pruning properly so called, as distinct from the first shaping that has been here described, will be dealt with in another chapter. It is easy to recognise in many fruit gardens, all over the country, the result either of entire ignorance of the art of tree-shaping, or of several years' neglect followed by a spurt of action with the saw and the knife. One often sees a clump of apple trees which have been duly planted and cut back, perfectly correctly, knee high or less, to four or five laterals. Then something has occurred to interrupt the care of the fruit-patch for a few seasons. The laterals have grown out and upwards into great boughs as thick as one's wrist. Anon comes repentance with the saw, and cuts them back shoulder-high, making a huge wound which will take years to callus over. A great crop of shoots rises from the dormant buds below the section, and the head of the tree above the post-like branches thickens up into a dense bush of barren wood with here and there a strong leader struggling outwards to air and light. Never having been stopped back they have no fruiting spurs, and blossom only on the last year's growth at the very top. In due time there appears on each of these flexible rods a bunch of apples jammed up against each other to get space to grow, and bobbing round in the wind. This is truly how not to do it. These are the places where *Schizoneura* or woolly blight, and *Selandria*, the pear-slug, most do congregate, and establish nests of infection to destroy neighbours' orchards for miles around. Indeed it would not be difficult to argue that if it be a sin and shame for a man by ignorance or neglect to fail in duly caring for his domestic animals, and if the law can be invoked to make him treat these dumb children of the Almighty properly, it is proportionately fitting that proper knowledge and due care should be enforced upon every man in the treatment of his fruit trees. It is asked "Shall not a man do what he will with his own?" the answer is, Certainly not; the law prevents him from doing very many things that either offend against the conscience, or create a nuisance to his neighbours, and that latter malfeasance is exactly what many orchards here and there are doing at present. They are becoming hot-beds of insect and fungous

pests which radiate away from their central home in all directions, and thus ignorance of cultural methods and the habit of letting things slide may render a man's fruit garden a curse to his neighbourhood. If he plants nothing, there is nothing to be said. If he plants trees, he is morally bound to care for them so adequately as to prevent their being mischievous to others, or else, by some such law as that which the government proposed for acceptance in 1895, his neighbours should be empowered to make him.

39. It may be well to hear what successful fruit-growers in other countries say as to this fruit-tree shaping:

1. "All deciduous fruit trees should in this country be cut back after planting to within twelve inches of the ground. I should prefer a head within six inches of the ground. Among my early plantings I can show trees with a clean trunk four to five feet high, and I keep a few of these as monuments of my ignorance. The rest I shall cut down and grub out. Leave three or four buds at the top of the tree, and don't worry if the first year some small branchlets come out all along the trunk. They will help to shade your tree, and you may have to use some of them to balance the head next spring. As a rule your tree will not need the knife the first summer, and while shading the trunk from sun-scald is wise, cutting low will generally give foliage to protect it amply."

2. "The top of the tree directly after planting out should be cut back to, say, fifteen inches above the ground. Let three buds grow at the top; three limbs are better than four or five. When twigs start out a little way below, pinch the terminal out and stop them. They then put out a few leaves and shade the trunk. In the following winter-pruning season cut off the three branches, leaving them about twelve inches long from the trunk. Allow each of them to send out two shoots, pinching back all others as soon as they start out as twigs. At next winter's pruning, the third year from the bud, cut off these six branches to eighteen inches in length. Each of these six is allowed to put out two shoots and the others are pinched back. The next year the tree has twelve branches, and has assumed a goblet form and is symmetrical, if care has been taken to pinch back all the twigs except those encouraged to grow."

3. "The best method to secure a tree with a low head is to cut the transplant off, not less than sixteen inches from the ground. Allow a few of the healthiest buds near the top to grow, taking care the head is evenly balanced. It is best that they be distanced a little, not all springing from close to the top. All stuff that comes out below these may be left to grow a few inches, and then must be pinched out at the bud, allowing the bunch of foliage to remain to protect the trunk till the head is large enough to do that office. Then the trunk is cleared off bare. Allow the shoots forming the head to grow uninterruptedly all through the first season. The following winter cut them back to ten or twelve inches, just above a series of strong healthy

buds. If the sort of tree is an upright grower, cut to an outside bud if it has a spreading habit cut to an inside bud. The second season, allow two shoots to start from each one of the parent branches, and treat as before. By the third year, you will have got a handsome symmetrical tree, and your after pruning is meant to keep it so."

So much for the practical advice of three practical men given in a country which of all others is most closely like our own in climatic conditions.

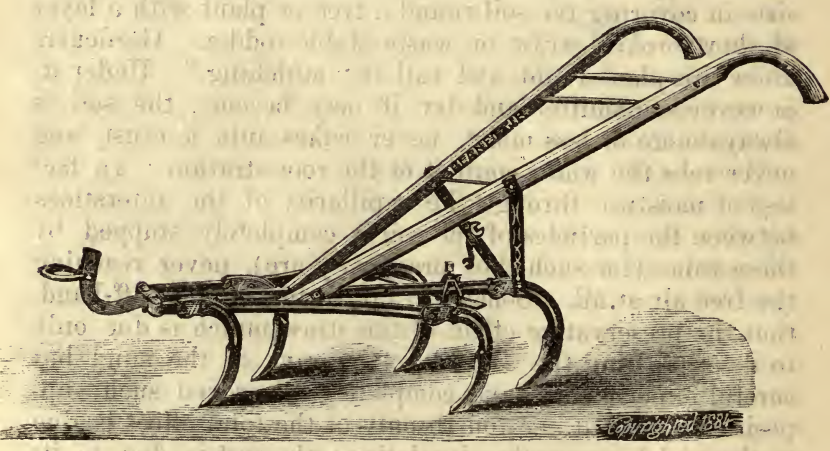
40. The modern orchard does not, like the garden of Eden, cultivate itself. It demands a full share of the attention lavished upon cereal crops. The condition of openness and aëration with free passage of moisture through it and away has to be maintained. Where the area set out to fruit trees is very large, as in California, the plough and harrow are the implements greatly relied on for bringing the tilth to a finely pulverized state. Their use involves considerable difficulty in working among the trees, and here, where we set out our trees as close as possible, they are not likely to come into vogue. Our vineyards are often worked with the spade, and our conservatism may perhaps make us adhere to that method till we learn to employ the "cultivator" altogether. This excellent tool is quite competent to cut up the soil to a depth of eight or ten inches, with the assistance of a steady mule. Its special advantage is that its chisel-shaped teeth open the soil thoroughly without materially disturbing its general evenness, thus avoiding the unhandiness of the plough furrows, all of which have to be turned back again and worked to a level with the harrow. The whole of the ground between and among the trees must be kept in an open, worked condition, not only because it would otherwise harbour weeds and other interlopers which would night and day draw from the soil that which of right belongs to the trees, but for another and more important reason. An open pulverulent tilth at the surface is the best preventive of evaporation from the underlayers in which the roots lie and perform their functions. As soon as a hard continuous surface-crust is formed, as, for instance, by drying out after irrigation, or after a beating rain, the uninterrupted capillary attraction exerted by the interstices of the soil-particles draws the moisture of the lower strata up to the heated crust, where it evaporates

as fast as transmitted. It is therefore not long before the feeding-bed of the roots under such surface-crust is far too dry for their proper function, the growth of root-hairs ceases, and the trees begin to show signs of flagging. Unfortunately the habit of many growers is to endeavour to set things right solely by running in an abundant irrigation and practically flooding the root-bed. As the water gets slowly away by percolation, most of it is evaporated from the surface and the crust reproduced, with the inevitable result of the same capillary rising of the very water just administered and its dissipation into the air. There is therefore a pernicious alternation of a fast and a feast forced upon the roots. The true remedy consists in interposing a loose, powdery or fibrous stratum several inches thick between the layers of soil in which the roots live and perform their functions and the external air, ever greedy of moisture.

41. Now there are two ways of doing this. One is of limited application, although it answers perfectly. It consists in covering the soil round a tree or plant with a layer of short broken straw or waste stable fodder. Gardeners know this plan of old, and call it "mulching." Under it, however sun-smitten and dry it may become, the soil is always more or less moist, never cakes into a crust, and never robs the water content of the root-stratum. In fact loss of moisture through the capillarity of the interstices between the particles of the soil is completely stopped by these tubes (for such they practically are), never reaching the free air at all. Some will take it for granted, off-hand, that the preservative effect of the straw mulch is due only to its shadowing the soil from the rays of the sun; but careful experiments have completely disproved such supposition. About one-fourth only of the total effect is due to the mulch preventing insolation; the rest is due to its stopping the capillary withdrawal of the soil's moisture-content at a point short of the evaporating surface. If then it were possible to mulch completely the surface of an orchard or vineyard in this manner, there would rarely, if ever, be so complete a drying out of the feeding ground of the roots as to cause flagging and wilting of the foliage. But the method is in a general way only applicable on the

small scale, as an artifice of the skilled gardener in his very restricted area. The efforts made to put it in practice in Californian orchards and vineyards have been limited through the extreme danger of destruction by fire which a large stratum of inflammable mulching material must always threaten. Still, cases are reported where it is in use on hill slope cultivation, where the chances of a disastrous wash-away are to be reckoned with, and it has proved quite successful for the double purpose.

42. Now just what the gardener in a small way over a few square yards can accomplish with a mulch of straw-refuse, the farmer can effect nearly as perfectly by making a mulch of his own powdery soil. If the top tilth is constantly kept broken up into fragments and never allowed to skin over into a close crust, it will almost as effectually check loss of deep seated moisture by capillarity as would a mulch of straw-yard sweepings. This then is the main reason why in all modern



orcharding on the large scale, the cultivator* is kept constantly going in the intervals between the rows of trees. Its eager teeth, like crooked chisels, cut into the soil some three or four inches deep, and being chamfered off laterally, the little broken lumps slip away sideways and lie atop of

* Figure represents the cultivator *without* the usual front wheel. The cut is kindly lent by Messrs. Lloyd, Burg Street, Cape Town, the agents for the implement. They invariably send it out for Cape use with the front wheel.

each other loosely. It goes without saying that the passage of the sharp tines ever and anon through the happy home of annual surface weeds cuts them off past recovery. The land becomes perfectly clean, like one of our vineyards, well kept at the cost of perpetual hoeing. Only such few weeds, as by reason of a perennial creeping root can survive and start again after being chopped up, will require hand-pulling. And thus by use of the interchangeable implements carried by the cultivator, a man may coulter up every square yard of his orchard into a loose protective earth-mulch, and even rake it mechanically to the smooth porous evenness seldom seen outside a garden parterre.

43. Seeing that the inevitable result of surface irrigation is to produce a close crust on the surface wetted and subsequently dried, it will follow that whoever irrigates must thus break up his top tilth into a mulch layer. Nothing is more strenuously insisted on by the most recent writers on fruit-culture, men be it remembered who are speaking of their own practice upon farms of an extent we have not yet begun to dream of. And what is more, the advice is acted on everywhere with more or less completeness. No better test of what cultivation a proprietor intends his land shall have, can be obtained, than that which is furnished by the particulars of the contract he makes with a temporary tenant holding the place in his absence. Wickson in his *Californian Fruits* specifies one such agreement, giving names of the parties concerned and the date. It is as follows:

"Contract price per acre for young orchard on gravelly loam, $12·50, comprising—First: Plowing away from the trees and harrowing to follow. Second: Plowing towards trees and harrowing to follow. Ten summer workings with cultivator. Three workings with shallow cultivator or weed-cutter. Five hand-hoeings around the trees. This contract intends the most perfect and complete working of the soil, and specifies the above in order that there may be no difference of opinion between owner and contractor."

44. It is also stated that in lands infested with "morning glory," a weed which is perhaps as troublesome as our Indian twitch, the rate is higher, and *weekly* workings with the cultivator are expressly stipulated.

Top Dressing—The Mode of Manuring Orchards.

45. In carrying out the perfect cultivation which is the basis of modern fruit culture, there is abundant scope for private judgment. With one person, winter ploughing and harrowing for the heavier part of the task, followed by the cultivator in one or other of its forms all through the summer, will be preferred, especially where the soil is apt to compact itself. In lighter lands the cultivator alone, kept going off and on all the year round, will give the result required with less costly labour. And in performing these duties comes the opportunity for whatever occasional top-dressing the soil may demand. That particular form of manuring, subsequent to whatever has been done during the first trenching up, is the proper way of keeping an orchard in heart and restoring the materials taken out by the trees for their substance and their fruit. It must not be done by guess work, or simply from the suggestions in the flaming advertisements of this and that firm's patent manures. It is necessary to find out what constituent of the soil is but poorly represented, and to keep this one in mind in future additions. At the Cape it may truly be said that the great and universal deficiency is phosphates. To the want of phosphates is due lam-ziekte of our cattle and sheep. They positively, on some land, cannot find in the herbage enough lime-phosphate or bone-earth to make their bones strong enough to carry their weight. Also in many corn lands there is now left the merest trace of phosphates, and the consequent weakened condition of the crop lays it open to destruction by fungus pests which would have been far less damaging to a crop in vigorous health. In many soils, lime is the great deficiency. We bring this needful building material from far, or are driven to use clay in place of it—sure proof of our lack of lime. In others potash is the special plant-food scantily furnished. Thus every man has to find out the weak point in the soil he cultivates before he can apply a rational remedy. We have given a list of the elements essential to plant-growth. All these must be had, although in very different proportions. Some are present in all soils, even in the most barren. Hence it is fair to say that fertilizing consists in

fetching up to par some one or all of these four elements, viz., nitrogen, potash, phosphorus in the form of phosphates, and lime. The best way to convince ourselves that the orchard soil must have them, is to take the ash of our common fruits and find out by analysis what mineral constituents are found therein, and how much of each. Every fraction of those constituents has been got out of the soil, and the practical outcome of manuring consists in giving them back again in such form that the plant can readily take them up. This table will make the matter clear.

	Potash.	Lime.	Magnesia.	Iron.	Phosphorus or Phosph. acid.	Sulphur or Sulph. acid.
Apple ..	35·68	4·08	8·75	1·40	13·59	6·09
Pear ..	54·69	7·98	8·75	1·04	15·30	5·69
Peach ..	74·46	2·64	6·29	·58	16·02	trace
Plum ..	59·21	10·04	5·46	3·20	15·10	3·83
Grape ..	63·14	9·05	3·97	·06	10·42	5·61

The above are percentage amounts. Those of soda and silica are omitted, seeing that these substances, although present, are not plant-food; nor does the table contain estimates of nitrogen or carbohydrates, for these substances are burnt off in the production of the ash. The woody substance of the trees themselves contains exactly the same elements. That of the apple-tree for example contains—

Potash.	Lime.	Magnesia.	Iron.	Phosphorus.	Sulphur.
19·24	63·60	7·46	·07	4·90	3·29

No one can examine the above percentages without clearly understanding what mineral substances go to make his soil fertile, and therefore what he has to give back to it in order to keep it so.

46. Let us take these fertilizers in their order. *Nitrogen.*—Trees take up what nitrogen they need as nitrates or as ammonia. In soils such as would be selected for orcharding, especially if prepared as directed in the preliminary

trenching, fruit trees will rarely suffer from deficiency of either. They are best applied in the indirect way by means of ordinary stable manure, if only the cultivator will prepare it properly. Raw dung that has not been rotted down has no business to figure as manure, and in light sandy soils may do serious mischief. Every man who means to act fairly by his orchard, will see to it that his manure-pit is covered up from rain and from sun, so that the contents are neither leached out by the one nor dried up by the other. The dung has to be kept at the degree of heat and moisture most favourable for its rapid fermentation, and be duly turned over to promote the perfect decomposition required. The dung only becomes manure and is suitable for the use of the orchard when it has fermented down into a brown mass of friable humus. Its manipulation serves two useful purposes, first, the due aëration without which the putrefactive bacteria cannot exist; and second, the prevention of too high a temperature, which would drive off the ammonia and materially lower the manurial value of the product. On no account should fruit-trees ever get a top-dressing of fresh guano. It is popularly supposed to be a sort of cure-all or receipt for universal fertility, but its improper use has done much mischief. With fruit trees is is so easy to give an overdose, and then it materially diminishes the production of fruit, and gives instead an inordinate growth of wood and leafage. It is fair to say that the only significance of guano to the orchardist arises out of the general poverty of his manure heap, particularly in phosphates. It does not often happen that he has the means of accumulating a stock of stable dung only. Sweepings of all sorts, prunings, brushwood, leaves, kraal droppings, all go in to increase the mass. To this there is no objection, provided it can be thoroughly fermented down; but from the nature of the materials the fermentation becomes a very slow process, and by the end of the year the manure, so-called, is only about half made. To make up its deficiencies and lack of ammonia and nitrates, a sprinkling of guano, previous to turning it over, may be admissible. But the cultivator must be well aware of the risk he runs, and give with a very sparing hand.

47. A series of analyses of the guanosupplied from the Government stores in the years 1891 to 1894 gives percentages of ammonia varying from 7 to 19 per cent., the average of fifteen samples being 13·53. Besides this ammonia, guano contains phosphate of lime and potash to an average amount of 16 per cent. It must be remembered that this phosphate of lime is only very slowly soluble, being in the tribasic condition.

48. It is a pity that hitherto no mineral phosphates similar to apatite have been found within the limits of the Colony. There are two sources whence phosphates can be conveniently obtained. These are, bones in the form of bone-meal or reduced to powder by fermentation, and a certain by-product of the iron manufacture, known in commerce as Thomas' slag. Although bones contain precisely that substance which is required in our soils more than any other, they are as a manure, extremely slow in their action, becoming available as plant-food only after being mixed with the soil for a very considerable time. Nor do all soils act on bones with equal rapidity. In well aërated open soils with a good deal of organic matter present, they decompose soonest; in clay soils they will lie for years without change. Everything depends upon the degree of fineness to which the bones are comminuted. Hence bone-flour acts most quickly,—bone-meal next, while the ordinary crushed bone, consisting of large pieces, acts very slowly. This is because the phosphoric acid in the bone has combined with the lime with great force, forming what is known as insoluble or tribasic phosphate. If it were not that the water which percolates through the soil is impregnated with carbonic acid, the bone-phosphate would remain unaltered indefinitely, but the slight percentage of carbonic acid in the water carries away one molecule of lime and leaves the phosphate in a new and more soluble form, known as dibasic or soluble phosphate. What is slowly done by the carbonic acid in open soils, may be done rapidly by mixing the bones, whether crushed or meal, with sulphuric acid. This powerful substance, when added to the extent of about one third of the weight of the bones, takes up the lime at once and leaves the valuable phosphate in a form in which it is

immediately soluble in the soil moisture, and ready for absorption by the roots. Such a mixture is known in commerce as super-phosphate, and is quite easily made by the cultivator himself on the small scale, provided that he has some knowledge of the corrosive nature of the acid he is employing. The mixture dries in a few days, and if the acid has not been used in excess, it may be safely preserved in gunny-bags until required. Owing to the solubility of its phosphatic portion, it will always be best used, at least in orchards, as a top-dressing only. It must be remembered too that half its bulk consists of sulphate of lime or gypsum formed in the decomposition of the bones by the acid. This of itself is a valuable manurial ingredient. It is the form in which plants most readily take up the lime and the trace of sulphur they require, and its effect upon any injurious soda carbonate, causing brackness in the soil is immediate and effective. Thomas' slag comes into the cultivator's hands in a very fine powder, and the phosphatic lime it contains is much more readily broken up by the action of the carbonic acid in the soil than is the case with ground bones. On an average it is found to contain from 36 to 41 per cent. of phosphate of lime, and therefore it compares favourably with the medium class of superphosphates which contain from 26 to 28 per cent. and with pure dissolved bones containing 20 per cent. soluble phosphate and 10 per cent. insoluble matter.

49. Confining our attention to the use of phosphates in orchards only, it would appear that Thomas' slag has a distinct advantage over other sources. It gives out the element required, slowly, yet with sufficient readiness. It does not throw all its content of phosphoric acid into the soil the first season; hence what may be termed its staying power has a distinct and great advantage. The man who applies bone-meal, hoping to secure this same staying power for a number of years, most certainly gets it, but unfortunately the amount of phosphoric oxide liberated per season by his bone-meal is excessively small. In fact, for a phosphatic manure it does not work quick enough. The sum of the whole matter may be put thus: superphosphates work too quickly, plain ground bones work far too slowly. Thomas' slag strikes a medium between the two.

50. We have incidentally referred to lime as one of the food-materials which are only scantily provided in average Cape soils. Of course there are places where the subsoil is calcareous, but these are few and far between. In the Karoo, deposits of lime are local, and apparently scattered about capriciously over that great area. It may be as well to observe that these incidental deposits have a curious and peculiar origin. They are clearly what mineralogists term kalk-sinter. When the Karoo in geological times was a great fresh-water lake, where the Dicynodon wallowed amid the mud and rushes, much as the hippopotamus does in Central African lakes this day, there were hundreds of places where springs rose up at the bottom underneath the sheet of water. These deep-seated springs were very largely charged with lime; in fact, they might have been called lime-water springs coming from calcareous strata lying at great depths. When their water reached the exit of the fissure at the bottom of the lake and diffused itself through the liquid mass, much of the carbonic acid gas, by the aid of which the lime had been kept in solution, was lost by diffusion. The natural result was deposition of a precipitate of lime all round the mouth of the fissure, making a sort of calcareous floor, extending perhaps for many yards in every direction, with the eye of the spring as a centre. This process of deposit would go on just so long as the fissure was open for the exit of the water. But in course of time the same causes that produced the deposit on the lake floor would cause a similar precipitation in the upper part of the fissure delivering the spring, and would ultimately choke it altogether. After that there would be an end to any further lime deposit in that place. One can easily understand this process going on at the bottom of the lake, when examining pipes which have carried a stream of calcareous water for many years and show their original calibre reduced by deposit inside to one half or even less. After the great upheaval of the claystone porphyry just south of the Karoo lake, numerous huge cracks were made on the southern edge of the Karoo basin. The water of the lake was drained off down the lines which we now recognize as the kloofs and passes of the Zwartberg, Langeberg and its other boundaries. The farmers of the Karoo are

now cultivating the flat bottom of the great Karoo lake, and here and there they come upon these restricted deposits of calcareous sinter, very convenient for either building or manurial purposes. It is a pity that similar stores of lime do not exist all over the Colony.

51. We have spoken of lime as a plant-food. No very large quantity is required, but there must be some. Given this small quantity, the remaining function of lime in the soil is something quite different. It sets up a chemical action, setting free in a soluble and available condition materials which existed in the soil, for instance, potash and phosphoric acid, but in an insoluble form, incapable of absorption by plants. There is plenty of potash in soils derived from a granitic base, but it is locked up in combination with silica. A generous application of lime combines with the silica and sets free the potash. The case is much the same with insoluble phosphates. Then it has a remarkable effect in assisting the nitrification of all organic manures added in the usual way. Also upon soils of a more or less compact clay its mechanical effect is very remarkable. It has a peculiar power of altering that mechanical condition of clay which makes it what is termed *colloidal*, that is, plastic and impervious to water. This condition is, for cultivation, about the most unpromising that there can be. It is scarcely possible to do anything with such earth by ordinary means. The only method is thoroughly to incorporate with it heavy dressings of lime and establish reliable drainage along the natural water-table. The result is that the clay becomes, as it is termed, "flocculated," or collected into little clots, around and between which moisture and air can intervene. Thus, and thus only, can plastic clay be converted into cultivable soil.

52. Turning back to the analysis of fruit-ash, it will be seen that the proportion of lime is considerable, amounting, in the apple, to 63 per cent., in the orange to 22 per cent., and in the plum to 10 per cent. Now all of this large amount has to be given to the trees. It is therefore a safe thing to be fairly liberal with lime top-dressings to most orchards which have not a calcareous subsoil. That is to say, the only soils where lime freely used will not be materially beneficial are those whose texture is

already very porous and open, and which already have the percentage of lime demanded as plant-food. In these its mechanical effect is not called for.

53. One is often asked what can be done to correct the objectionable brackness or alkalinity of some of our soils, so that some kind of an orchard crop can be obtained from them. Once for all let it be stated that ordinary lime has no curative effect; what is wanted is gypsum, that is, sulphate of lime. The brackness known locally as zwart-brak is due to carbonate of soda, a substance actually poisonous to plants. The sulphate of lime exchanges constituents with it, and you get sulphate of soda and carbonate of lime as the result. Now although sulphate of soda is not a desirable thing for one's soil, yet it is not nearly so mischievous as the carbonate would be. Hence it is quite possible for a cultivator whose circumstances oblige him to work on an area which is more or less zwart-brak to make a very tolerable culture off it by dint of a generous application of gypsum. Before many years are past, the few places where gypsum deposits are known to exist will have a future before them.

Green-manuring and Snatch-crops in the Orchard.

54. There is yet another method of adding to the manurial constituents of the soil which should not pass without notice. This is the raising of a quickly growing annual crop between the rows of trees and turning it in with the plough or cultivator to decompose under the surface soil. Nitrogen and organic matter form the principal gains derivable from this so called green-manuring upon the large scale on corn lands; they scarcely apply to the smaller scale of orcharding. Thus, short of complete rotation of crops, there is no better way of checking wire-worm in corn-lands than by raising a snatch of rape or colza as early in the season as is possible, and turning it under just before it flowers. The insects that harbour in an orchard however, are very different from the wheat-grower's wire-worm, and

its nitrogen is much better added by means of stable manure or chemicals. Besides, one of the greatest improvements of modern times in relation to orcharding is the custom of keeping the whole of the orchard area free from any growth whatever—from weeds of course, and from snatch-crops also. It has to be a well kept, pulverized, bare surface acting as a mulch and air-absorber for the underlying root-stratum. Will it ever be so at the Cape? Perhaps not, just yet. Old habits will be too much for us, and we shall for some years yet go on growing our small stuff in among the trees in the orchard. Be it so, since we as yet know no better. But the great thing to be remembered in all these snatch cultures (allowed to exist because of the hardness of our hearts, and perhaps we may say—of our heads), is that nothing whatever can be permitted except such things as salads, onions, pumpkins, melons, all annual crops, which deal only with the very superficial layer of soil at the surface. It would be truly suicidal policy for a man to lay down a crop of lucerne for instance, among his trees. Its roots would soon get down a full yard deep and try conclusions with the apple and peach roots to their very great disadvantage. Yet such things are done in this year of grace, 1896. Besides, there is a fatal temptation in the matter of green manuring. It is so easy to deceive yourself into fancying that you are letting the weeds run riot all over your orchard of set purpose and as an act of wisdom, because you mean some day, not fixed, to turn them in as green manure. Depend upon it, the man who lets weeds grow to avoid the labour of keeping his land clean all through, will find plenty of excuses for avoiding the labour of turning them in. And then what are we to call his orchard? A plot with a great many trees and a few weeds, or a mass of weeds with a few trees among them? If there were no other argument against green-manuring than this, there would be enough to leave it prudentially out of the canon of fruit-growing.

TREES.

THE APRICOT.

It will be understood from the general preliminaries respecting the forming of trees from the year old graftling, that the balance of experience at the Cape is in favour of low dwarf trees, because of their occupying less space, coming into bearing sooner, and being far less exposed to injury from high winds and the accidents of harvesting. The tendency to push the standard pattern with tall axial growth has been a fashion of late, just as a few years ago, men coming out here with a European experience only, condemned our Cape habit of pruning vines in the *gobelet* dwarf style, and would fain have us set up poles and trellises. We venture to say that the dwarf orchard tree will remain in vogue after most of the experimental standards have been cut back and regrafted.

The apricot pushes so vigorously and fast that special foresight is required to prevent it from growing beyond its strength and courting its own destruction by too liberal spreading of branches. It is advisable to take *all* trees as graftlings of a year old from the nursery, if you understand their management; but this precaution is specially necessary with the apricot. Let the shoots you encourage for main branches be alternately set, step-wise, on the 12-15 inch main axis left after planting, and as far as possible balancing each other all round the tree. It is bad policy to have three or four branches springing from what is practically the apex of the stem, like a Y with many arms. One may easily secure this alternating outspring by rubbing out a bud here and there and letting the intermediate ones develope themselves. Precisely the same precaution has to be taken in the development of shoots arising after

the second and third prunings. The result is that a well managed apricot tree shows very few clear Y joints anywhere. The arms of the Y come out askew to each other, one of the pair starting always a little lower down on the branch it springs from than does its mate of the same season.

We said the apricot is over lavish in its growth and fruit. Therefore, bearing in mind that abundant foliage means abundant elaborated sap, permit a fair show of short laterals to push out from the main branches, and do not look upon them as gourmands consuming the strength of the tree. Crush the soft end with the thumb and finger when they have advanced 4 or 5 inches, and let them make what foliage they will. It is advisable to keep the fruit-buds as near the main stem as possible; you may always be certain of the quality of the fruit produced there. The second years' formative pruning is generally best made to an inside bud all round. This has the effect of throwing the growth of the tree inward, and as a natural consequence the whole weight of the head, and also the considerable additional burden of fruit in its season is held much more perpendicularly over the main trunk than would be the case had the outside bud been encouraged and the arms allowed a wider angle of expansion. It is surprising how greatly the leverage of the dead weight upon the forks of the limb may be relieved by this forecast. Branches with which no care has been taken are liable to split away from their holding at the fork, owing to the comparative brittleness of the quick-growing apricot wood, and an unsightly scar and ill-balanced tree results. Nor is the matter much mended if the owner, detecting the dangerous leverage that threatens to terminate in the splitting of a principal fork, helps the tree with an iron hoop bracing the limbs of the fork together. Such makeshifts may save the branch in a high wind, but they are confessions of bad management and of not knowing one's business properly. The fruit is borne on the wood of the previous year, and as the habit of the apricot is to rush out into needlessly long shoots, these must be shortened back sharply every winter and more sparingly in summer. All ill-placed interfering branches, and weak watershoots have to be sacrificed.

The vigour of the tree is such that the head will each year fetch up a somewhat rounded outline instead of a flat top, particularly if the practice of cutting to an outside bud is followed.

The choice of stocks for the apricot lies between self-seedlings and peach seedlings. Experience has shown that the great yellow St. Helena peach makes an excellent stock provided the soil is open, well worked and well drained. It will not however stand the abuse of unnecessary irrigation. That piece of mismanagement is quick and sudden death to the peach as soon as the outlets for free seepage get clogged. If the soil is not favourable to the peach, self-seedlings may be used, or in still harder conditions, plum stocks have the best chance. Of these the recently introduced myrobolan plum is highly commended. Its use however is too recent here to allow of actual experience being quoted. In places where the soil is naturally very dry or the subsoil rocky and innutritive, the almond may be used. Opinions differ much as to its value, some declining to use it on the ground that the graft does not make a sound junction with the almond stock, and is liable to be blown out by the high winds or to snap off. Others recommend it from trial, claim for it a special fitness, and maintain that it makes a satisfactory adhesion. It is probable that both views are right in their own way, that is to say that the looser textured wood of the apricot as grown in rich fertile soil does not fit the harder tissues of the almond, but that when its rampant tendency to rapid growth is checked either by more sterile soil or drier atmospheric conditions, its wood-layers approximate more to the texture of those of the almond, and a better junction results. To this view tends the tradition of French nurserymen, that the almond is a preferable stock in arid chalky uplands. They use by preference the hard-shelled sweet variety. In the Eastern United States with a colder climate than ours, the plum stock seems to have the preference. The varieties which succeed best here are, Moorpark, Hemskirke, Royal, Grosse Pêche, Breda and Blenheim. The last two are the hardiest, although rather small. The first-named variety demands special care in shortening in, otherwise it is rather shy in

bearing. In all sorts of apricot moreover, thinning is to be recommended. Without this provision the crop runs to number at the expense of size, and growers of fine fruit remark that to take off half the fruit that sets gives a greater weight of product than if the entire setting had been left on the tree to take its chance. This raises the whole question of quality *versus* quantity about which Cape growers have hardly made up their minds.

Apricots.

NAME.	DESCRIPTION.
Moorpark.	Fruit large, roundish and compressed on the sides, marked with shallow suture. Skin pale yellow in shade, deep orange with red specks in sun. Flesh deep reddish orange, particularly rich.
Hemskirke.	Fruit above medium, round, flattened on sides, suture distinct. Skin yellow and reddish next the sun. Flesh bright orange, tender, rich and juicy.
Blenheim.	Large, oval. Skin deep yellow. Flesh yellow and tolerably rich and juicy. This is a very productive variety.
Royal.	Large, oval and slightly compressed. Skin dull yellow tinged with red, suture shallow. Flesh pale orange, firm, rich and vinous.

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THE PEACH.

To those who have a fair professional acquaintance with fruit-tree growing, built up from an apprenticeship, journeyman days as an improver, and the reflective observant leisure of foreman and head-gardener, the case of the peach at the Cape is one for commiseration. The tree is so liberal of its growth, so generous with its fruit, so patient of ill-usage up to a certain point, that it has become the *souffre douleur* of the careless, and the favourite of those who think that potatoes and onions require care and attention, but trees can look after themselves. Of late, many orchards of ten or fifteen years standing, with trees

set in holes amid untrenched ground, have come to the end of their possibilities. The increasing compactness of the soil, drenched and dried alternately, and the clogging of what natural drainage existed along the water-table slope, has slowly killed out the roots, and the topmost branches, with the imperfectly ripened late wood of the year, die back to the usual stag-horn pattern. Then follow attempts to revive the tree, hot manure to the collar, and excessive flooding by irrigation. The whole root-system becomes involved in the mischief, and we have a case of what we may term "Cape Peach Yellows." It is such a pity that the art and mystery of tree-growing is treated so differently from other arts and mysteries. No man pretends that with a piece of leather, an awl, and a few wax-ends, he can make a shoe, on the strength of having seen and worn shoes all his life. A man who pretends to cure diseases without having passed through the severe study and practice of the medical schools is—we all know—a quack, that is a mixture of rogue and fool in varying proportions. Yet every third man you meet in the country will undertake to plant an orchard and grow peaches without having learned the first principles of the gardener's art. It is but to dig holes and put trees in—what more would you have! The trees do the best they can for him as long as possible. At length they succumb. Even their exceptional vigour and hardiness gives in at last. If we are going to do things right and act fairly by our trees we must study their special wants and provide for them. The peach demands one thing above all, that is a thorough and free drainage. The actual content of the soil itself is of much less import than the great requirement of unchecked respiration of the roots, and that can only be got by ensuring the rapid escape downward and away of all the natural rain, and still more of the artificial irrigation water, sucking in the vital air it holds in solution. No planned drainage—then no veteran peach trees,—nothing but short-lived invalids cut off before their prime. The soil must be a sandy loam, with a tendency to dry out rather than to retain moisture. Sodden clay is not worth the labour required to bring it by liming and vegetable manure to anything like the proper soil for the peach. Just as your soil gets further away from the

definition of being clayey, and fulfils the conditions of an open mellow loam, the clods of which break in your hand to fragments like meal, so will it benefit the noble peach.

However, something may be done to humour the peach in the matter of soil. If one *must* work in heavy clayey land, because of lack of other choice, then after effort at improvement by liming to flocculate the clay, and addition of strawy manure to open it into air pores, the plum stock may be grown for grafting on. There is one disadvantage however; most plum stocks sucker very much under the peach and give a vast amount of trouble. Of late years the myrobolan or cherry plum has been used and answers well, being free from this objectionable habit. But wherever the main conditions we have insisted on are reasonably fulfilled, the peach or self-stock is to be preferred. There can be none better than the great yellow St. Helena peach for most localities. But in this widely varied land, where our working altitudes range from sea level to 5,000 feet, the grower must not go by book only. He must look around and observe for himself which seedling peaches in his neighbourhood are hardiest and finest, and choose these for his stocks. When the ground is stony, shaly and dry, the sweet almond may be used. But in that case a little skill is requisite, something beyond the rough cleft made in the stump and the scion wedged into the split. It is astonishing that such rude work ever succeeds. We believe that—given a suitable dryish soil and careful whip or tongue grafting—it is very little we should ever hear of the standing complaint against these stocks, that is, of young trees blowing loose from their almond mother-stock.

Twenty feet is outside measure for the peach distance. Some modern growers give more, but this is rather in obedience to a general consensus of opinion that the old crowding system must be discouraged and discontinued. Thanks to the enterprise of a few of our nurserymen, very excellent yearlings may be had, either self-stocks or myrobolan. Do not fancy you are getting more for your money by buying two year olds. The peach is in such a hurry to get along and make growth, that you are likely to have a

very perplexing lot of laterals already started on the two-year saplings. Beginners find it difficult to harden their hearts sufficiently to cut all these close and leave a scarred uneven-looking foot of stem. Some nurserymen pinch out the apical bud at a bare eighteen-inch height, and encourage three or four laterals which will make a ramping growth of five feet or more in the first season. These are cut back to nine inches in winter, and are delivered to purchasers who thus get a yearling plant with a two year old head on it. We cannot do better than quote the directions of a practical fruit grower who has in our very midst shown the way to success. He says :—

"After shortening the side branches of the tree in its first year's growth to the length required, by cutting back to a bud, inner or outer, right or left, according to the shape required, a long growth of young wood will be thrown out. An amount of a quarter to three-quarters of this can be then cut away, according to the taste of the grower and the distribution of the fruit buds. After this pruning in a peach tree, one can expect a small crop, and during the cutting one should keep an eye on the double or treble buds, that is, the fruit buds, in view of inducing a crop. As the tree gets older the same course of cutting back and thinning out should be pursued, with intent to produce a quantity of new or bearing wood successionally each year, thus enabling the pruner to distribute his coming crop over the whole tree. Nor should he forget the leaving of such well-matured wood which may be forced out from the main stem as shall tend to balance the general set of the tree and equalise its bearing. The branches left in this way should, of course, be cut back in due course, leaving only a few more fruit-buds that are wanted for the following year. In fact, on the peach no laterals should be left of their full length, and the pruner must always look to the fruit-buds, and never forget he is cutting the bearing wood. You will occasionally see your fruit-buds near the points of the branches. Under these circumstances you must leave them, and do more thinning out of branches. Some farmers have asked me if I approve of summer pruning the peach tree while in its fruiting stage. I say most emphatically no, because by doing this you cause a double growth of new wood, entailing twice the amount of cutting."

It is necessary to call attention to the difference between the leaf-bud and the flower-bud, in the peach and other stone fruits, as a guide to keeping the balance of wood and fruit. The bearing shoots in the peach and nectarine always show towards their base a number of acute solitary buds with a brown scale-cover. These are leaf-buds. Higher up will be seen a smaller number of buds standing three together, a thin one in the middle, with a plump

silvery-coated one on each side. These latter are flower or fruit-buds. Your object is to encourage them rather than the other, many of which may be rubbed out, but as the trees bear on the last year's wood, provision must be made for fruit-bearing shoots for the next year, to come on in succession. Those buds then which are best placed are to be left for this purpose while you are disbudding the remainder.

Major Downing, the veteran American pomologist, gives directions for peach-pruning in a similar strain. He says:

"If the trees are left to themselves, the growth is mostly produced at the end of the principal branches, and the young shoots formed in the interior of the head die out. The consequence is that the head is filled with long lean branches provided with young shoots only at their extremity. Anyone can see that such a tree can only possess half the number of healthy bearing shoots that it would have had if filled throughout with vigorous young wood. The sap flows tardily through the long rigid branches and there are not half enough leaves to secure the proper feeding of the fruit. Such fruit as there is comes at the ends of the branches which often break under the awkwardly placed weight. Instead of this we substitute the *shortening in* method of pruning. As early as may be the work begins, *i.e.*, cutting back half the last year's growth over the whole of the tree. As the average is from one to two feet we shall take off from 6 to 12 inches. It need not be done with precise measurement; indeed the strongest shoots should be shortened back most in order to bring up the others, and any long projecting limbs that destroy the balance of the head are cut back to uniform length. This brings the tree into a well rounded shape. By reducing the young wood to one half, we apparently reduce the coming crop one half, so far as number of fruits is concerned. But the remaining half, receiving all the sustenance the tree has to give, come to double the size. The young spurs which start abundantly from every part of the tree keep it well supplied with bearing wood for next year, and the greater size and luxuriance of the foliage, as a necessary consequence, produce larger and more highly flavoured fruit. Remember, in shortening back, to cut to a *wood-bud* for the finish of each shoot. Else you may have fruit coming out at the very tip, unsheltered by leaves and certain to drop early or come to nothing."*

It is scarcely possible to avoid saying something upon the subject of what is known in the United States as Peach Yellows, and about which there was recently a scare in the Colony, contemporaneous with the spread of American Pomological literature among us. Seeing that one of the acutest practical investigators, Erwin F. Smith, utterly

* Fruit and Fruit Trees, pp. 584, 585.

failed to discover any bacillus or other fungoid parasite, and relinquished further enquiry as fruitless, it is probable that the cause has been sought for in the wrong direction, and that yellows is not a morbid condition produced by parasitic interference, but something far simpler, viz., constitutional exhaustion brought about by a long course of bad cultivation, as regards soil, abuse of irrigation, neglect of skilled pruning and continuous over-cropping. To avoid repeating here the conclusions come to and published in the *Agricultural Journal* after a close examination of numerous supposed cases of yellows in the Colony, we will subjoin, on this matter, the views of the eminent pomologist from whom we have already quoted :—"We believe the malady to be a constitutional taint produced by bad cultivation and exhaustion, and perpetuated by sowing the seeds of the enfeebled trees, either to obtain new varieties or for stocks. Let us look for a moment to the history of peach culture. For a hundred years after its introduction it was largely cultivated in perfect freedom from disease and with the least possible care. The natural fertility of the soil was then unexhausted, and the land occupied by orchards was seldom or never cropped. Most of it, though at first naturally fertile, was light and sandy, and inevitably in course of time became exhausted. The peach, always productive to excess in this climate, was no longer able in the impoverished soil, to recruit its energies by annual growth, and gradually became more and more enfeebled and short lived. Wheat and grain crops bore high prices, and the failing fertility of the orchard land was still more lowered by a system of heavy cropping between the trees without returning anything to the soil. Still the peach was planted, left to produce a few heavy crops, till it declined from sheer feebleness and want of sustenance. It was then the custom for orchardists to raise their own trees from seedlings, and the nurserymen collected the stones quite indiscriminately for raising stocks. Hence it is evident there were present all the conditions for passing on a constitutional debility of the parent trees in a greater or less degree to the seedlings. Still the system of allowing the tree to exhaust itself by heavy and repeated crops in a light soil was continued, and generation after

generation of seedlings, each more enfeebled than its predecessor, at last produced a characteristic feeble and sickly stock of peach trees throughout the district. The great abundance of the fruit caused it to find its way into all the markets along the sea coast. The stones from the fruit thus introduced into the Northern States, being esteemed something better than those of home-growth, were everywhere more or less planted. They brought with them the enfeebled and tainted constitution derived from the parent stock. In the new soil they re-produced the old failings of their worn-out constitution, and thus, little by little, the morbid condition or the so-called "yellows" spread to the whole Northern and Eastern sections of the Union.

From the history, let us turn to the nature of this enfeebled state of the peach tree. Every good gardener knows that if he desires to raise a healthy and vigorous seedling plant, he must select seed from a parent that is of itself decidedly healthy. Professor Lindley, in his *Theory of Horticulture*, justly remarks: "All seeds will not produce equally vigorous seedlings, the healthiness of the new plant will correspond with that of the seed from which it sprung." Again, the great Flemish pomologist, Dr. Van Mons, declares that the more frequently a tree is reproduced continuously from its own seed, the more feeble and short-lived do its descendants become. Moreover, the peach is peculiarly constant in the reproduction of any constitutional variation that may have arisen. A signal proof of this is seen in the nectarine, which is merely a variety of peach with a smooth skin, and not a distinct species at all, yet it is perpetually re-produced without reversion by sowing its seed. It is evident from these premises that the constant sowing of the seeds of an enfeebled stock of peaches would naturally produce a sickly and diseased race of trees. The seedlings will often appear healthy at first, but the taint will sooner or later show itself, and especially when the tree is allowed to produce an over-crop. That bad soil conditions and over-bearing will produce great debility in any fruit tree is matter of common observation. Even the apple, the hardiest of orchard trees, requires a whole year to recover from the exhaustion caused by an unthinned crop. The great natural luxuriance of the peach induces

it actually to form new fruit buds while the branches are still loaded with fruit, and thus, if not restrained by pruning, is soon enfeebled.

These are some of the facts open to every day observation which point towards this theory. The varieties most subject to yellows are those which produce the heaviest crops. Slow growing sorts and those which produce but sparingly, like the nutmeg peaches, are almost entirely exempt. We know an orchard where every tree has gradually died from yellows except one which stood in the centre. It is the Red Nutmeg, and is still in full vigour. It is certainly true that these sorts often decay and suddenly die, but it is always from the neglect which allows them to fall a prey to the peach-borer curculio. The frequency with which the peach-borer's work has been confounded with yellows by ignorant observers renders it difficult to arrive at correct conclusions respecting the supposed contagious nature of the latter disorder. It may be said in objection that a disease which is only enfeeblement of constitution would not result in speedy death. The answer is that the degree of debility produced in a single generation of trees would not have led to such effects, or to any settled form of constitutional disease. But the same bad management has been going on for nearly a century up to this day, the whole country over. Every year, in August, the season of early peaches, thousands of bushels of fruit showing the infallible symptoms of yellows are sold in the markets. Every year the collected stones of these peaches are planted, to produce in their turn a generation of diseased trees, and every successive generation is more feeble and sickly than the last. So feeble has the stock become that an excessive crop is too frequently followed by the yellows. In this total absence of proper care in selection of seed and trees, followed by equal negligence as to cultivation, is it surprising that the peach has become a tree comparatively difficult to preserve and proverbially short-lived? In Europe, the peach is always subjected to a regular system of pruning, and is never allowed to produce an over-crop. Its lavishness is kept under control. Now yellows are unknown in Europe, and notwithstanding the great number of American varieties of this fruit sent over and now growing there, the disease has never extended itself or

been communicated to other trees, or even been recognised by English or French horticulturists."

It is scarcely possible to read this opinion of the veteran pomologist of America without recognizing that similar conditions have existed here in the Colony. Not one in a hundred has for himself made the observation that the peach is apt to ruin itself with overbearing, and has therefore carried out a vigorous system of pruning back in winter and shortening in summer, to keep the output within the limits of the trees' powers. Not one in a hundred has trenched up the whole strip of land on which the trees stand and secured to them a free rapid drainage. Is it then wonderful that, encouraged to bear to excess, with roots weakened for want of free aeration and perpetually waterlogged once or more a week, the peach tree succumbs at last, and dies slowly of what we have called yellows, but which is really exhaustion above ground and root-asphyxia below?

If it be asked, what remedy is to be had for what has been taken at the Cape for yellows, the reply must be founded upon this view of its cause. The system or no-system of culture must be altered. If planted in the old way in holes, a French drain must be taken out along each row a little lower than the original bottom of the holes, connecting each, and having a good outfall. This prevents the mischief of waterlogging. The whole area of the trees must be dug with the digging fork—not with the spade—as deep as possible without getting seriously among the roots. A top-dressing of lime should be turned in at the same time, not so much for the purpose of adding to the food-constituents of the soil as to aid in making available the humus elements present, setting free potash, and, if the soil be clayey, flocculating its texture to admit air. The unhealthy parts of the tree should be cut away, and the whole gone over discreetly with the pruning knife to reduce the demands made upon the weakened root-system. Work of this sort is as interesting to the skilled gardener and the observant amateur, as the conduct of a difficult case is to a physician. But people who do not care much for their garden, and look on their trees merely as machines for saving market cost of purchased fruit, had better not try to bring them round. It would be far less trouble to stub

every one of the unlucky victims of bad management completely out, and begin over again by trenching up, draining properly and replanting.

Selection of Sorts.—Such parts of the country as belong to the coast region, and do not rise above 500 or 600 feet above sea level, have the best chances of topping the market with early sorts and securing the high prices brought by their first appearance. At higher levels, earlies are not of much account. They are elbowed out of competition when they appear by middle sorts from the lower and more precocious level, and they are very likely to catch a snap of late frost when blooming. This is the danger of our clear, cloudless nights in early spring. The heat of the day, accumulated in the earth, is radiated away rapidly into space when there are no clouds to send it back, and during the hour before dawn the mischief is done. It is "black frosts" due to radiation that mostly cut off the early blossoming fruits of the high veldt. As to the modes of combating the evil by smudges of smoke and by netting, consult the *Agricultural Journal*, vol. v., p. 252. Peaches intended for canning should be white or yellow self-coloured sorts. Those which are red-stained at the stone colour the syrup. They are much better suited for drying, for the rosy tint on the inside curve has an inviting appearance. All that can be done here is to give details of a few of the very best sorts. It cannot yet be said that known pedigree kinds have been to any extent recognised as peculiarly suitable to this or that special locality. No one has troubled himself about pomology and the climatic distribution of fruit sorts at the Cape, and nearly all the data are yet to be received and recorded. The best approved sorts are Alexandra, Brigg's Redmay, Crawford's Early, Crimson Galande, Grosse Mignonne, Noblesse, Royal George, Sea Eagle, Susquehanna.

Peaches.

SORTS.	DESCRIPTION.
Alexandra.	A freestone peach of the largest size. Fruit marked with a deep suture. Colour, pale with red dots next the sun. Flesh, white, quite pale at the stone, tender, melting, juicy, very good.

SORTS.	DESCRIPTION.
Bellegarde.	One of the handsomest and most delicious peaches. Fruit large, round and regular, the suture shallow, with projecting point. Skin pale yellowish green with a rich red cheek, often streaked with dark purple. Flesh juicy and rich, free stone.
Brigg's Red May.	One of the very earliest. Fruit round, large, suture almost round it. Skin nearly white, flushed with bright red. Flesh white, tinged with red at the stone.. Very juicy and sweet Free stone.
Crawford's Early.	The finest of all early yellow-fleshed peaches, a most taking fruit. Fruit large, oblong, with shallow suture. Skin yellow with fine, red cheek. Flesh yellow and melting, sweet, rich and very excellent, Free stone.
Crawford's Late.	A later free stone variety of the above, and similar in every respect. As a market fruit it is unrivalled. Flesh deep yellow, red at stone, juicy and melting, with vinous flavour.
Crimson Galande.	Fruit medium and roundish, skin almost covered with dark crimson. Flesh tender, melting, blood-red at stone. Free stone.
Early Alexandra.	A very early ripening sort. Skin greenish-white nearly covered with red. Flesh firm and juicy and partially free stone.
Early Beatrice.	One of the earliest. Fruit medium size with marbled red cheek. Flesh melting and very juicy.
Early Rivers.	Fruit large, pale straw-colour, with a delicate pink cheek. Flesh melting, rich and juicy. Free stone.
Foster.	Fruit very large, slightly flattened. Flesh yellow, very rich and juicy. Colour deep orange, dark red in hue. Free stone.
Hale's Early.	An early free stone peach, fruit medium size, nearly round. Skin greenish and mottled with red when ripe.
La Grange.	A large white free stone peach of late habit. Skin greenish white with red on sunny side. Flesh pale, juicy, melting, very rich, high flavoured and delicious.
Muir	A most desirable variety. Fruit very large. Flesh clear yellow, dense, rich and sweet, a good all round sort. Free stone.
Royal George.	Fruit above medium, suture deep and broad. Skin pale with red dots. Flesh whitish but very red at the stone, melting, juicy and rich. Few peaches surpass this one in flavour and beauty. Free stone.

SORTS.	DESCRIPTION.
SUSQUEHANNA.	Fruit large, nearly globular. Suture half round. Skin rich yellow, with a beautiful red cheek nearly covering the whole surface. Flesh yellow, sweet, juicy, with a rich vinous flavour. Free stone.

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THE APPLE.

At the Cape, the difference of climate and rainfall between West and East affects the apple very considerably. In the former, it is far less sought after and valued than are the peach and the pear, and the evidence of the seasonal market all goes to show that growers for sale have hitherto been satisfied with a few varieties and those rather poor ones. Choice apples of the very best sort are only to be found in a few amateurs' gardens and rarely appear on the market. Those most commonly seen appear to be bastard seedlings of the Red Astrakhan or some similar sort, and have passed through many stages of degeneration. In general they come late and stay long, and this is their main virtue, for neither in flavour nor size have they much to recommend them. Of late, however, most of the best kinds have been introduced and are now readily obtainable. The climate of the South-West coast region is not very favourable to the apple. It requires a season of complete rest. Hence its demands are best met by the dry, cold, and practically rainless winter of the Eastern Province. Westaway it does extremely well as soon as the higher levels are reached, and probably the Koude Bokkeveld will one day be a noted apple-growing country, in virtue of the more uniform low temperature that prevails during the season of winter rest, in contradistinction to the capricious alternations of temperature of the coast-level. On these cool uplands the apple-tree is not forced into too rapid growth and premature bearing. It is likely that when fruit culture is better studied, high veld farmers will grow and send away an immense and creditable apple crop to coast markets, even as Kent, Gloucester, Hereford and Devon do in England.

The apple is not nearly so hard to please in the matter of soil as most other fruit trees. Provided its moderate requirements of lime, potash and phosphates are supplied, the nitrification going on in all soils under culture, with the ordinary stable manure in moderate supply, is amply sufficient to supply nitrogen. The present fashion of heavy top-dressing with guano and other ammoniacal manures is to be deprecated. They have a tendency to produce wood and foliage instead of fruit. The only soils in which the apple is not likely to repay culture, (if the climate suits), are thin dry sands and sodden clays. A strong loam may be a good apple ground if it has plenty of lime naturally, or if lime be artificially added. Even heavy granitic clays, derived from the decomposed felspar, will grow apples when well limed to set free the potash which they contain in an insoluble state, and to flocculate the otherwise impervious mass. Probably the magnesia derived from the mica particles in these soils has an influence, for no fruit contains so much of that substance as does the apple. To the recognition of this fact is due the modern practice of giving an occasional light dressing of Kainit to the apple orchard, that mineral supplying both potash and magnesia. But in all cases a quick ready drainage is essential, and in clayey loams it has to be expressly provided. Probably it will not be long before a demand arises for orchard drain-tiles. Drains laid with these are less expensive to dig and lay than any other sort, and if the bed is evenly cut to the given slope, they never fill up. The $2\frac{1}{2}$-inch size is sufficient for branches and 4-inch for the main run. With similar machinery to that which is now turning out excellent bricks for the main drainage of Cape Town streets, there would be no difficulty in producing Cape-made drain-tiles in any quantity and at a reasonable rate.

Propagation.—Seedling stocks are raised from the pips of known sorts which have been recognised as strong growers. In England the crushed pulp of the cider-press is washed over and the pips separated. The special cider-apples are all strong vigorous sorts, hence there is the less need for particular selection. Some growers prefer the pips of crab wildings. But of late years the convenient

fashion of dwarf low-headed trees has led to the general use of the Paradise Doucin stock which produces a characteristic dwarf growth, just as quince stocks do for the pear. There is however one unfortunate disability about it. The Paradise stock is very liable to the attacks of the woolly American blight insect, *Schizoneura lanigera*, which is, in a less fatal degree, the scourge of the apple as the phylloxera is of the vine. Of this insect there are two forms or stages, one subterranean, on the roots, the other aerial, on the trunk and branches. The latter can be combated with comparative ease by repeated spraying. But no efforts avail to cope with the underground enemy and make a full end of him. Even bisulphide of carbon can hardly be applied in sufficient dose to destroy the insect, without seriously injuring the roots themselves. And if the colonies on the stem and branches be killed out completely, new emigrants creep up from below, moult and change into the aerial form, and renew the plague. Exactly what has been done to circumvent the phylloxera on the vine roots is now being done in regard of the *Schizoneura*. It has been found that several sorts of apple, particularly the Northern Spy and the Winter Majetin, enjoy a comparative immunity from the attacks of the *Schizoneura*. Fortunately these two sorts have each their special character. The former has a strong erect growth and a compact fibrous root. The latter tends to make a more horizontal spread of branches, and has long rambling roots. There is little difference in their resistent power. Hence the Winter Majetin is selected for loose sandy soils of slight consistency, and in these its peculiar root-habit gives it a firm hold and enables it to maintain itself when a Northern Spy would certainly be blown over. All that has been said respecting the necessity for reconstituting the Cape vineyards upon the resistent *riparia* and *rupestris* may in a less urgent manner be pressed upon the attention of the fruit-grower whose speciality is the apple, and it would be well for those who are for the first time starting an orchard to refuse to purchase any apple graftlings which the seller cannot guarantee to be worked on one or other of the stocks above mentioned. For the present, doubtless, growers will be content to purchase their grafted resistent apple yearlings from those who

make a business of supplying them. The method they follow is simple enough, though tedious. It is a form of double grafting, and is not likely to be popular among private growers. The operator picks out healthy portions of the roots of the resistent variety, about a span long and $\frac{3}{8}$ of an inch thick. Upon these, scions of the same resistent apple are grafted, taking care that both root and shoot are of equal diameter. The English graft, so called, or whip-graft with a tongue, succeeds best. To utilize pieces of root of smaller diameter, there is an ingenious device which might be called spur-grafting. This is easily understood from the figure, which, with some of the above details is taken from an excellent resumé of apple-culture by A. H. Benson in the *N. S. W. Agricultural Gazette*, vol. v. p. 314. (May, 1894).

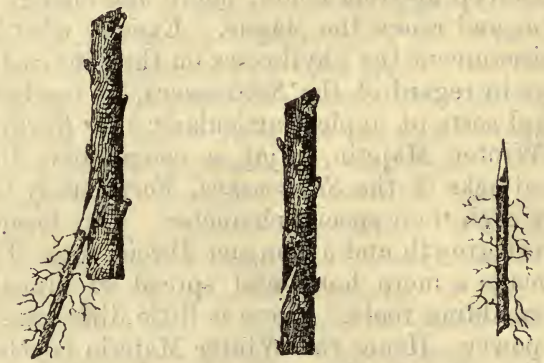

Figure 7. Details for Root-grafting.

A cut is made obliquely upwards near the scion, reaching almost to the central pith. The root-piece is cut to a double bevel of the same length as the cut in the scion, and inserted so as to match exactly its outside edge. In this, as in the former case, the junctions are to be carefully tied with raffia, slips of cotton, torn instead of cut from the the piece, or worsted. No waxing is to be applied. The grafts are set out in nursery beds with the junction well below the surface, and great care is taken by mulching and other means to prevent drying out. The surfaces soon unite. The strongest and best placed bud on the graft is allowed to develop into a shoot, and all the rest are rubbed

out. After a year's growth, when the grafting season comes round again, the special variety required is grafted upon this shoot, or if the shoot be strong enough, budding the selected sort may be done the same season. When these have made a start, you have a pedigree apple with a resistent trunk-base and resistent root. But both Majetin and Spy are strong-growing kinds of apple, and give their habit of growth, more or less, to the scions they bear. If therefore a dwarfing effect is desired, an additional step is requisite. Upon the resistent shoot, at the end of the first year, there is grafted a Paradise scion. When this is established satisfactorily, and the proper season arrives, the ultimate variety wanted is budded or grafted upon this Paradise intermediate bearer, and thus a peculiar dwarfing effect is transmitted to it. Thus we may finally have a tree which is, for example, Ribstone Pippin in its head of branches and upper stem, Paradise at the base and collar, and Winter Majetin at the roots. Perhaps some will consider a crop of apples not worth all this trouble. But this compilation is not written for those who want to avoid trouble. Those who long to grow apples without the never ending warfare with the woolly aphis are the people addressed, and they will take any amount of trouble to be quits with the enemy, and also will not grudge the extra sum of threepence per tree charged by the nurseryman for his apple trees guaranteed to be worked upon resistent stocks.

Planting and Growing.—It has before been stated that it is best to purchase graftlings of a year old. When planted the little apple trees are cut back about knee-high, not only to give the roots the best chance of making a vigorous start before they are called on to supply moisture to a head of leafage, but far more to enable the grower to form the tree to pattern. It is a very common practice for those who have started a garden with no gardening knowledge to plant trees just as they come from the nursery and let them grow as they will. If you were to go to these amateur places, whip out your knife and cut the little apple trees down to knee-height, the owner probably would never forgive you. You might explain that a yearling with twenty or more buds, all starting, could not fail to grow a besom head of

useless wastrels, crowding each other, and making fruit spurs only at the end of each switch. Whereas when only three or four of the buds are allowed to shoot from the cut-back remainder of a similar yearling, there would be as many fine strong radial bearers running up for a year, to be pruned back in winter for an exactly similar production of secondary radial shoots. You might explain and get a grudging acquiescence. But you would always be looked upon as a sort of horticultural Herod among the Innocents. The great thing to be desired is that no one should undertake planting and training fruit trees unless he will consent to be taught by seeing the skilled practice of others. It is a common custom to leave more of the stem of an apple tree and a pear than would be done with stone-fruit trees. But care must be taken to let no more than four or five buds start on, and to choose these so that they divide the stem among them evenly. Thus, let the first be about nine inches above the ground, the next four or five inches higher and pointing not exactly opposite in direction, but about a third of the way round. Still higher, let the next bud-shoot start another span higher and fetch up another third of the circle. Clearly, if this be done with a little judgment, your mature tree will have a much stronger wood-system as its foundation, than if all the three or four main branches started away from just about the same height. Nor is it advisable ever to permit more than four or five of these to go to the making of the tree. Four is decidedly preferable, and adhering to that number, small as it seems when the tree is young, will save an enormous amount of labour in after years in cutting out the useless perpendiculars that always form within the head of a tree that is too crowded.

If you have as yet no practised knowledge of sorts, begin from the first to acquire it by observation of the little ways your trees affect. They betray themselves to you, or rather, make you their confidant as you walk among them. Some sorts will let you see that they like to draw themselves in and run upwards as if they were imitating a poplar. Very good, it is for you to remember that habit, and always or mostly to *cut to an outside bud*, when pruning. You are their master—a skilled master you should be—

and it is for you to lay down the law to your trees and make them obey. If other sorts are altogether too loose and careless, flinging their branches around, remember that peculiarity against them when the pruning season comes round, and conversely let the apical bud to which you cut point inwards. No grower should go through a strange orchard without mentally taking stock of the trees and the way they have been treated. The general habit of each kind, new to him, should be carefully noted and remembered. Such and such being its mature aspect, it follows that when you get it as a graftling of a year for yourself, you can recall what you have seen, and knowing what it should grow into, prune it accordingly. And when such experience enlarges, and you begin to feel able to rely upon it and to produce the exact effects you wish, you have taken the first step into the inner circle of gardening. You are no longer an outside philistine amateur, nor even an apprentice, but a passed-master of the craft.

Sorts of Apples recommended.

In giving the names of apples for choice there is great difficulty because of the utterly different conditions of east and west, coast and upland.

Apples.

SORTS.	DESCRIPTION.
Adams' Pearmain.	One of the finest dessert apples, a good exporting variety. Pale yellow tinged with green, covered with russet on shaded side, but deep yellow streaked with red on sunny side.
Blenheim Orange.	A good dessert and keeping apple. Fruit large, roundish oblate, yellowish, becoming deep orange, stained on sunny side with dull dark red stripes.
Ben Davis.	A handsome popular American variety, a dessert apple recommended for export. Yellowish, striped and splashed with two shades of red, with areolar spots.
Bismarck.	A large handsome showy cooking apple. Rich yellow, speckled all over, rich broken streaks of crimson on sunny side.
Beauty of Kent.	A showy and juicy kitchen apple of strong-growing habit. Fruit very large and roundish, but flat at the base and narrowing to the ribbed eye, greenish yellow with stripes of purplish red.

SORTS.	DESCRIPTION.
Cox's Orange Pippin.	One of the finest dessert apples. Fruit medium, oblate, yellowish shaded, splashed and mottled over the whole surface with crimson. Flesh firm, juicy and yellowish.
Cox's Pomona.	Good kitchen apple, flesh white and juicy. Fruit medium, oblate, greenish yellow, shade of crimson in the sun.
Cellini.	Good dessert and kitchen apple. Fruit medium, roundish oblate, deep yellow, with streaks and mottlings of dark crimson.
Calville Blanche.	Valuable cooking and dessert apple. Fruit medium, conical flattened at base, lemon yellow with red in sun. Flesh white, fine grained, tender, acid.
Canada Reinette.	An excellent variety; fruit of the largest size, very handsome. Oblate conical, flattened, broad at base. Greenish yellow, slightly washed with brown, sprinkled with dots and russet patches. Flesh nearly white; firm, juicy, rich.
Cleopatra.	Valuable export variety, suitable for dessert and kitchen. Greenish yellow, few green specks intermixed with a thin grey russet and tinged with brown on sunny side.
Devonshire Quarrenden.	A table and export variety of high merit. Medium size, roundish, flattened and slightly narrowed at the eye. Skin rich deep crimson, sprinkled with green dots. Flesh nearly white.
Dutch Mignonne.	A popular apple. Fruit large, roundish, oblate. Skin dull orange, half covered with red dotted and yellow russet spots. Flesh yellowish, rich and aromatic.
Duchess of Oldenburg.	Handsome dessert or cooking apple of vigorous habit. Fruit medium, regular, roundish, oblate. Skin smooth, streaked with red on golden ground with faint bloom. Fruit juicy.
Ecklinville Seedling.	Good table variety, an excellent cropper. Fruit large and handsome.
Emperor Alexander.	Well known cooking apple, greenish yellow, streaked partly with red and orange and covered with russety dots. A good bearer.
Golden Noble.	Valuable cooking apple. Large, roundish, conical, bright yellow with few reddish spots and patches of russet. Flesh yellow and tender.
Gravenstein.	A superb apple. Tree very vigorous and productive. Fruit rather large and flattened. Skin greenish yellow at first, but becoming bright yellow and pencilled with deep red and orange. Flesh tender and crisp, with highly aromatic flavour.

SORTS.	DESCRIPTION.
GLORIA MUNDI.	One of the largest apples. Showy for dessert, rather than for use or profit.
HAWTHORNDEN.	An excellent market apple, cooking. Fruit above medium, regularly formed, roundish and rather flattened. Skin smooth, pale yellow and nearly white in shade, but blush when exposed to sun. Flesh white and of pleasant flavour.
HUBBARDSTON NONSUCH.	Fine large apple. Fruit roundish, oblong, narrower near the eye. Skin smooth, striped with splashes of pale and bright red. Flesh yellow, juicy, acidulous.
JONATHAN.	Beautiful dessert apple of good flavour. Medium size, regularly formed, roundish conical, skin thin and smooth, light yellow with red stripes, deepening into dark red in sun. Flesh white.
KESWICK CODLIN.	A noted cooking apple. Fruit above medium, rather conical, with a few obscure ribs. Skin greenish yellow, with faint blush on one side. Flesh white, juicy and pleasantly acid.
KING OF TOMPKINS COUNTY.	A valuable market fruit. Large size, globular, inclining to conic. Colour yellowish, mostly shaded with red, striped and splashed with crimson Flesh yellowish with rich vinous flavour.
KING OF THE PIPPINS.	A medium sized apple, roundish, oblate, pale yellow, mixed and striped with red. Flesh firm, sharp, sub-acid.
LATE BLOOMER.	A valuable late apple, probably a Cape seedling, hardy and prolific, resembles Astrakhan, but of far finer flavour. Medium size, deep crimson. Flesh crisp and juicy. A good keeper and eminently fit for export.
KLAPROTH.	An excellent market apple, medium size. Form oblate. Skin greenish yellow, streaked and stained with red. Flesh white, and very crisp, pleasant sub-acid flavour.
LORD SUFFIELD.	Valuable cooking apple, recommended for shipping. Fruit above medium size. Greenish yellow with tinge of red in sun. Flesh white, tender, firm, sub-acid.
MONMOUTH PIPPIN.	Fruit large, oblate or slightly flattened at base and crown. Colour pale yellow with a beautiful warm cheek and russet dots. Flesh juicy, fine, brisk, aromatic, sub-acid.
MÈRE DE MENAGE.	Fruit very large, conical, yellow, shaded and striped with red. Flesh firm, crisp, juicy and sub-acid. This is a good showy market apple.

SORTS.	DESCRIPTION.
Northern Spy.	One of the best dessert apples. Fruit large, oblate, roundish, conical. Skin thin, smooth, greenish pale in shade, but in sun marked with pale dots. Flesh white, fine-grained, tender. Roots blight-proof.
Oslin.	An excellent apple. Fruit below medium. Form oblate. Colour, clear lemon yellow when quite ripe, with few grayish green dots. Flesh yellowish, firm and crisp.
Peasgood Nonsuch.	A good keeping apple. Fruit large and of good flavour, recommended both as a dessert and cooking apple.
Pumpkin Sweet.	Large sweet apple. Roundish, furrowed near the stalk. Colour pale green with whitish streaks and dots. Flesh white and very sweet.
Red Astrakhan.	Handsome dessert apple. Fruit fairly large, very smooth. Skin deep crimson and occasionally a little russet near the stalk. Flesh, white, crisp, rich acid flavour.
Rhode Island Greening.	A well known favourite apple. Fruit large, roundish, a little flattened. Colour dark green, becoming yellowish when ripe. Flesh yellow, fine grained, tender, crisp, rich acid juicy flavour.
Rome Beauty.	A late apple. Fruit large, roundish, approaching conic, yellow, shaded with bright red and light dots. Flesh yellowish, tender, juicy, sub-acid.
Ribston Pippin.	A well known dessert apple. Fruit of medium size, roundish, greenish yellow, mixed with russet near the stalk, dull red on sunny side. Flesh deep yellow, crisp and rich.
Roxbury Russet.	A popular table apple. Fruit above medium size, a little flattened. Colour, brownish yellow with faint blush on one side. Flesh greenish white, juicy with sub-acid flavour.
Sturmer Pippin.	A dessert apple. Fruit below medium, oblate, approaching conic. Yellow with a bronzed or crimson cheek. Flesh compact, rich, sub-acid. A good keeper.
Striped Winter Pearmain.	An old variety. Fruit large and roundish, inclining to oblate. Yellow, striped with red and gray dots. Flesh yellow, juicy, crisp and sub-acid.
Scarlet Nonpareil.	Dessert apple of medium size. Roundish, oblate, conical. Whitish colour shaded with red. flesh yellowish, white, firm and juicy ; sub-acid flavour.
Stone Pippin.	Good all round apple. Fruit medium size, conical. Colour pale green, becoming yellow. Flesh very firm, almost sweet.

SORTS.	DESCRIPTION.
Stirling Castle.	An excellent kitchen apple, keeps well. Fruit large and showy.
Warner's King.	Fruit very large, roundish, ovate, deep yellow with russet dots and patches. Flesh white, tender and crisp.
Wellington.	Late cooking apple, large, round, somewhat flat. Yellowish white with red on sunny side. Flesh firm, cri-p and juicy, with aromatic flavour.
Worcester Pearmain.	Dessert or cooking apple. Fruit medium size, handsome.

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THE PEAR.

Of all fruits raised in the orchard the pear is the one which bears up most sturdily against neglect and ill-treatment. Given an orchard, abandoned for a few years, the first trees to die out are the tender peach and apricot, then follows the orange. The apple comes next, over-run by the hateful woolly aphis above and below ground. Lastly comes the turn of the plum, exhausted by excessive suckering, and when it has dwindled from a tree to a stump with a bush of water-shoots atop, the pear will often still keep up a show of foliage, and perhaps still tempt the prowler with a few fruits as reminiscences of former fertility. The pear wants so little and gives so much.

The soil best adapted for the permanent growth of the pear is a moderately strong loam with enough lime in it to ensure its openness, situated upon a dry subsoil. It is impatient of flooding, and is put back by wet hanging about the roots for want of free drainage. Soils that are exceptionally rich stimulate a rampant growth of wood incompatible with good bearing qualities. Apart from extremes, however, the pear is not nearly so fastidious as the peach, and gives excellent results with any ordinary garden soil kept reasonably open and well drained.

The pear is essentially a "dessert" fruit, and is of somewhat more limited service than the apple. But it is just as distinctly a "keeping" fruit. In some respects

even it has an advantage over the popular apple, if growers know their business properly. Let us see what this amounts to. Stated as a maxim resulting from experience, it is that the pear is never delivered by the tree in a state of perfection. The peculiar flavour of the choicest sorts, for example, Beurré Superfin, Beurré Clairgeau or Duchesse d'Angoulême, is not developed by the active chemistry of the sunshine and air. To do justice to the fruit it must be picked at an early outdoor stage of ripeness, and transferred to the lower temperature of a storehouse. There, amid cool air and away from the light in closed boxes or on shelves, the tissues have time to eliminate slowly the special amylic ethers which give the pear its distinction, and melt down the insipid cell contents into a rich buttery syrup. To eat pears from the tree is very poor epicurism, and argues small knowledge of the capabilities of this luscious dessert fruit. It is just such want of skilled judgment in picking and skilled handling in the storeroom which has led some to affirm that the climate of the Cape is unfavourable to the production of any but the commoner sorts of pear. The observation and experience of one season devoted to learning the trick of the pear, as to precise degree of out-ripeness, with dark storage to follow, would settle once for all that easy libel on the land we live in. And pray consider how this speciality of the pear plays into the hands of the merchant, as if of direct intent. There is nothing to prevent the storage-mellowing from being given while the fruit is in transit. It may easily be taken from the tree in the comparatively flavourless condition at which it will just *lift* from the spur on the palm of hand being placed below, and gently pressed against it, be packed in that state, and in due time come to judgment at some distant market in the highest possible condition—a mouthful for the gods. What more could a fruit do to assist the market grower?

If this speciality of the pear were universally known and acted up to, the fruit would soon take its proper place as a dessert delicacy of the highest class, and fine grown specimens would sell at dessert prices. And as it is no more costly to grow good fruit than bad, there would probably be an end to the sackfuls of wretched little green

abortions which crowd our markets. The fruit-store or ripening-house should be fitted with skeleton shelves made of battens laid fairly open. These serve for ordinary fruit requiring free circulation of air and some manipulation from time to time. For pears, however, there should be provided flat shallow boxes with a close flap-cover, hinged on with leather strips. The depth will be about four inches, and the length and breadth about 24 by 18 or 20 inches. On the bottom is laid a very thin layer of buckwheat chaff, if it can be had, or finely cut and dried new straw. Over this goes a piece of cheap woollen stuff, and on it the pears are laid, close but not touching. The cloth is large enough to fold right over and cover the fruit completely. Then the lid flaps down and puts the pears in the dark. According to the kind, a space of time varying from three or four days to nearly as many weeks intervenes. All that is necessary is to remove any individual pear that has suffered a bruise, undetected at time of storing, and is bletting. If allowed to remain it would injure the flavour of its neighbours. In this way the fruit ripens to a rich, buttery consistence, possesses the indescribably delicious pear flavour *in perfection*, and takes the eye with a smooth skin and a high golden colour never seen on the fruit out of doors. There are many sorts which, without such treatment, ripen only to a dry, mealy consistence, flavourless, and even gritty. Winter pears of dessert kinds should hang as long as possible on the tree, and then be wrapped in paper, singly, and put away for keeping. Batches of these, in their turn, are transferred, a fortnight before use, to a warmer room at about 60° to 65°, and with this rise of temperature they too become buttery in consistence and full flavoured.

In the propagation of pears it is inadvisable to bud or graft on the chance suckers which rise in the orchard from the roots of other pears. Sucker stocks are generally poorly rooted, and follow their kind in producing suckers themselves. They therefore do not do full justice to the scion. It is far better to raise seedling stocks from strong, vigorous, common varieties, avoiding seed of the choicer sorts, in which the vegetative system has been more or less sacrificed to the fruit-bearing function. The raising of good pear-stocks re-

quires more attention than is necessary for those intended for other trees. The fruit should be quite ripe so that the seeds come away from the flights of the core. It should not be allowed to dry out, but should be drill-sown while still soft in deep rich soil that has been previously trenched and manured. If the ground has been enriched with a little wood-ash, to supply potash salts, it will be all the better. The seedlings then have a chance of vigorous growth during the first year. This is all important, for if not secured, the plants seldom turn out well subsequently, and one often sees poor, starved lots of pear-stock seedlings, three and four years old, raised anyhow in hungry soil, and, despite their age, far less fit for use than stuff grown as here suggested, and only twenty months from the sowing. Budding is to be preferred to grafting, and there is no tree which gives so few failures as the pear, when in good condition, owing to the thickness of the cambium layer on which the buds are worked. To secure a large percentage of buds that take well, it is important to have the stock as vigorous as possible, and decidedly in advance of the vegetative stage to which the bud-sticks have reached. This is secured by selecting the bud-wood some five or six weeks prior to the season most suitable for budding, and carefully laying in the twigs in a sheltered, shady situation in good soil, where they will lie by in a dormant condition while the stocks they are to serve are getting well ahead of them. This adjustment of *forward* stock-tissues to comparatively *backward* bud-tissues is a rule of practice invariably observed by the skilled propagator.

The pear will take kindly to many stocks besides its own. In England it is sometimes grafted on the white-thorn for use in stiff, clayey soil, where pear roots would not thrive. Some fanciers graft on the mountain-ash and medlar. Even apple stocks will carry a pear graft, but the accounts given of the result are contradictory. The American authorities say a pear on apple stock is very short lived, speedily killing itself with profuse fruiting. Stoll, the director of the experiment station at Proskau, recommends grafting of pear on vigorous young apple stocks, but acknowledges that their early productiveness is counter-

balanced at the cost of longevity. The current practice in California, whose climate resembles our own, is to adhere to the self-stock, mainly because the custom there is to allow the trees to run up to standard size, often reaching thirty or more feet high. It is true, doubtless, that more fruit is produced by a given number of standard trees than can be got off as many dwarfs. But it must be remembered that an acre of land will carry many more dwarfs than it will of standards, a consideration which pretty nearly squares the comparison. Besides, with our violent gales and curiously perfunctory orchard labour, fruit borne aloft twenty to thirty feet above ground has scarcely one-tenth of the chance of getting harvested safe and sound that comes naturally to the fruit of dwarf trees hanging barely out of reach of a long arm. Taking all things into consideration, we are of opinion that at present the practice of pear growers will be towards dwarf trees rather than standards, and, in that case, self-stocks capable of use and giving good results will not be greatly called for.

The dwarfing stock *par excellence* for the pear is the quince. The pear bud takes kindly to it, grows vigorously, and the resulting tree bears early and well. There are just a few exceptional pear sorts which fail on the quince, and of these note will be taken hereafter. But the general statement holds good, and it may even be affirmed that most of the very large pears whose weight renders them liable to be shaken off by the greater swaying of the boughs of standard trees, not only hold on better to the dwarf growth, but are distinctly improved in their characteristic flavour. Nor is this to be wondered at. There are two distinct tendencies in the fruit-tree—one is for the maintenance of the purely vegetative life of the individual, the other for reproduction of its kind by fruiting and consequent seed. The former results in vigorous wood-tissue, plentiful branching and abundant foliage, the latter naturally runs to fruit-bearing. Given an orchard tree—pear in this instance—which is not to be left to itself, but artificially dealt with to the profit of its owner, it is clear that the over-production of wood and foliage must be kept back by skilful treatment. The need of that check on vegetative tendencies is the *raison d'etre* of pruning. But

let the same tree be grafted or budded on a stock which materially controls the ascent and descent of the sap, it is equally clear that we obtain a further check on rampant vegetative growth, and give an additional preponderance to the reproductive fruit-bearing tendency. The tree grows more of fruit and less wood. There too follows a practical corollary of some importance. Soils which are barely sufficiently fertile to give tolerable results with self-stocks will not prove satisfactory with those of dwarfing kinds unless assisted by judicious enrichments. The check upon the vegetative individuality of the tree may easily be carried too far if the poverty of the soil comes in as a further negative factor. Hence the well-founded custom of coupling rich soil with the use of dwarfing stock.

There are several sorts of quinces, as distinct as sorts of apples of a given race. The question as to which one suits this or that sort of pear has not yet been taken up in earnest and worked out. Unfortunately the scientific habit of recording the data of pomological work at the time it is performed, and subsequently collating results years afterwards, is exceptionally rare. Yet by such investigation of results it would be easy ultimately to arrive at valuable practical conclusions, and to be able to allot special quince stocks to special categories of pears. Doubtless this will be done some day. At present we are in the stage of pomological ignorance, in which a quince is a quince, and all quinces are alike. In France and Belgium, the pear countries *par excellence*, the Angers quince is recognised and selected for exceptional vigour. Most of those scattered all over the Cape appear to be derived from the Orange Quince, and occasionally one will meet with what seem to be seedlings of the broad-leaved strong-growing Portugal sort. Many of the better varieties have been imported recently, and are now in the market. The celebrated fruit-grower, Mr. Thomas Rivers, who was one of the first to introduce cultivation of the pear on quince stocks, has a note upon the disputed longevity of such trees. He says: "I have so often heard from market gardeners and others the opinion, 'It is no use to plant pears on quince stocks for they will not live long,' that whenever I have seen pear trees of mature age, I have looked to the stock to ascertain its

nature, whether it was pear, quince or white thorn, for I have known some healthy free-bearing pears grafted on the latter. Thus at Deepdene, near Dorking, I observed a number of fine pyramidal trees. They were all worked on the quince, and the gardener assured me they had been planted thirty-four years. They are very healthy and are growing in a soil of the driest and lightest description. Presuming that they were three years of age when planted, they must be now nearly forty years old, and most certainly appear as if they would live and bear fruit for twenty years to come. A light, porous soil overlying a cool stratum is, I believe, the most favourable for the pear or quince stock. Hence should the soil in which they are to be planted be heavy and stiff, it should be corrected by a light compost, or pears on pear stock substituted."

Allusions have been made to the dislike which some fine sorts of pears seem to show to the quince stock, and the consequent difficulty of getting a perfect union. This is particularly marked with the Jargonelle, with Marie Louise and Bergamot Gansel; less distinctly with Beurré Clairgeau, Beurré Rance and Beurré d'Angleterre. As a general rule cleft-grafting has a better chance of success in these cases than simple budding. But the more satisfactory procedure is that of double grafting. Upon the quince stock is first worked a vigorous pear sort which takes kindly to it. After perfect union and sufficient growth, generally two years, the pear shoot is headed back and made to carry the bud or scion of the desired variety. Thus the vigorous Beurré d'Amanlis makes a most perfect intermediary between quince and Jargonelle and the two others above-named. Other strong growing sorts—*e.g.*, Beurré Hardy, Vicar of Winkfield, Beurré Noisette, Lavinicu, Jaminette, Beurré Vert—may be used to carry more tender or more fastidious pear varieties, which, even if they make a sound, direct union with the quince stock, are rendered thereby slow of growth.

In this system of over-grafting, with its opportunities for new combinations, there is a great field open for experimental trials, and the last word respecting pear-culture on dwarfing stocks has by no means been said. A well known scientific gardener, Mr. F. W. Burbidge, draws

the attention of amateurs to this promising branch of enquiry, and points to the results already obtained by his contemporary, Dancer of Chiswick, whose garden sends out annually hundreds of baskets of the very finest dessert pears to the London markets from bush trees all worked upon the quince stock. He declares "there is no comparison between fruit produced on standard or orchard trees on the pear or free-stock, and that from bush trees on the quince."

Pears.

Names.	Description.
Bon Chrétien.	Fruit large, obtuse pyriform, irregular and bossed in its outline. Skin smooth, pale green but ripening to clear yellow, tinged with streaks of red in sun. Flesh white, fine grained and tender, musky and vinous in flavour. A dessert pear of the highest merit.
Beurré Clairgeau.	Fruit large and very handsome. Curved pyriform. Skin smooth and shining, lemon yellow, tinged with orange and red in sun. Flesh white and crisp or half melting, sugary, vinous, perfumed.
Beurré Bosc.	Dessert pear of high quality. Fruit large, pyriform, dark yellow, streaked with cinnamon, russet. Flesh white, melting and buttery, slightly perfumed.
Beurré Hardy.	A large dessert pear of great excellence. Oblong-obovate or pyramidal. Skin yellowish green, covered with russet dots. Flesh white salmon tinted, melting and juicy, acidulous with delicious perfume.
Clapp's Favourite.	Fruit large, obtusely pyriform, surface uneven. Skin pale lemon yellow, splashed with crimson and fawn on sunny side. Flesh white, grained and juicy, buttery, melting, good flavour, delicate, like Bon Chrétien but not musky.
Doyenne du Comice.	One of the best. Fruit large, roundish, pyriform. Skin greenish-yellow, clearing when mature, and often shaded with crimson, and patches of russet dotted about. Flesh white, fine, melting, sweet, rich and aromatic.
Duchesse d'Angoulême.	Grand dessert pear of large size. Fruit very large, oblong-obovate with uneven surface. Skin dull greenish-yellow spotted with russet, sun side red. Flesh white, juicy, buttery with rich flavour.

Names.	Description.
Easter Beurré.	One of the best late pears. Fruit large, obtusely-obovate, roundish. Skin yellowish-green, sprinkled with russety dots, brownish cheek. Flesh white, fine grained, very buttery, with a sweet and rich flavour.
Fiorelle.	Most attractive dessert fruit of a speckled appearance. Fruit oblong-obovate and smooth, at first green, but yellow when ripe, with deep red on sunny side. Flesh white, fine-grained, buttery, melting and good.
Fertility.	A profitable market pear, abundant cropper. Fruit medium size. Flesh half melting, juicy and sweet with a highly perfumed flavour.
Idaho.	An American pear of the largest size. Fruit roundish with russety spots, colour, greenish yellow. Flavour rich and vinous.
Josephine De Malines.	Fruit above medium. Skin yellow with greenish tinge, but red on sunny side and covered with russet spots. Flesh yellowish red, melting and very juicy, sugary, vinous and richly flavoured.
Louise Bonne.	Most delicious pear of medium size, oblong-pyriform. Skin smooth, greenish yellow on the shaded side and red on side next the sun, covered with red and russety dots. Flesh white, buttery and melting, very prolific.
Marie Louise.	Fruit large, oblong. Skin smooth, pale green, changing to yellow, marked with tracings of russet. Flesh white, delicate, buttery, rich and sweet vinous flavour.
Souvenir du Congrès.	A very handsome pear. Fruit large, oblate, uneven and undulating in its outline. Skin smooth and covered with cinnamon russet. Streaks of crimson on sun side. Flesh yellowish white, tender, very juicy and melting, resembling the Bon Chrétien.
Seckel.	One of the richest flavoured pears. Spicy and honey flavoured. Fruit small, regular, obovate. Skin brownish green, after ripening turning to dull yellow with russet red cheek. Flesh white, buttery and juicy.
Winter Nelis.	A good keeping winter pear. Fruit medium size, roundish, obovate. Skin yellowish green dotted with grey russet. Flesh yellowish white, fine-grained, aromatic, buttery and very melting.

THE PLUM.

The chief practical difficulty in the growing of plums of sorts, grown as formerly on the plum stock, was the vast proportion of suckers sent out. The portion of the orchard given up to them used to become full of these waste shoots in a very few years. To avoid this result, many growers used peach stocks. It was found that only a limited number of plum sorts would thrive on that stock, and, moreover, there was always the objection that unless the ground is thoroughly drained the peach roots are apt to die off. Everybody now knows the way peach trees in heavy soils are apt to fail, though the cause is put down to "yellows" or anything else rather than to the want of a well aërated root-bed. Both difficulties are avoided—the former completely, the latter to some extent, by the use of the myrobolan as a stock. It does not sucker out, and it is not so tender at the root as the peach. On the whole it may be recommended as the best general resource for average soils. At the same time in places where the soil is light and sandy, it may be advisable to use the peach for stocks, and the grower must decide on the course he takes, by observation of the growth and success of these two trees on their own roots in established orchards in the locality in which he intends to begin planting. Formerly the apricot was a favourite stock, but it is now very properly disused. It makes a very indifferent union with the plum, and when the tree has got up high enough to catch the wind it generally breaks away at the joints. But whenever the soil is retentive through a large percentage of clay, the Myrobolan will give the best results. Wickson points out the variability of success of the plum upon peach, apricot and almond, and it would appear that not only is difference of soil an element in the matter, but also there are certain plums which will not succeed upon a given stock while others answer admirably. He therefore recommends, as an all-round stock, the use of the Myrobolan (which practically places the plum upon its own roots) until such time as experiment shall have shown the special fitness of some other stock in the locality which may be in question.

It must be remembered that the plum is by no means easy to bud or graft in a very dry climate. Care must therefore be taken to choose not only the precise season for the rising of the sap in the stock, but also to judge of the local weather which prevails at the time of taking the job in hand. Insert the buds, by preference, on the south side of the stock, work quickly, and tie somewhat more tightly than is usual with other buds.

Comparatively speaking, the plum is a very hardy tree and equable in its growth, which never reaches above a moderate height. It may therefore be permitted to run to the standard shape, if the particular variety tends that way. Most varieties will balance themselves pretty uniformly if the ordinary care be taken the first year or two in shaping the head. The plum will allow of a larger number of principals to be left after the second year, and this will result in making the usual bushy or pyramidal head. The plum really requires very little pruning beyond thinning out a too crowded head, which is almost all the winter pruning that the tree will bear; in the summer a pinching back and thinning out of the laterals is recommended. The object is to produce as many as possible of the short spurs which carry the fruit. Hence such long straight laterals as may be retained must be shortened in to at least half their length, and upon them the expected spurs will begin to start ready to carry the next year's crop. At the apex of these laterals new growths will be formed in their turn, and such of these as are retained must be treated in the same way.

Perhaps the most important feature in plum growing is the production, on a commercial scale, of the dried prunes. It is probable that the output of this wholesome and excellent product will in a few years double itself again and again, while the growing of plums for market for ripe fruit will have but little significance. The best imported French prunes are made of the Prune D'Agen, Brignole or Maître Claude. But other kinds of plums are also used. The fruit is gathered when just ripe enough to come away easily, and laid without touching on frames of lath. On these it is exposed for several days to the sun until quite soft. Every example that is the least touched by insects

or bruised is carefully picked out. The frames are then arranged in a slack oven, closed up, and left for twenty-four hours. The fruit is then taken out, turned and picked while the oven is being reheated to a somewhat higher degree than before. Again the fruit goes in for the same length of time, removed and examined. A third time the oven is heated, and after remaining in it for a third twenty-four hours, the fruit is finally removed and left to get quite cold. Each separate prune is then rounded up by turning the stone in the plum without breaking the skin, and pressing the two ends together with the finger and thumb. The frames carrying the manipulated fruit are now returned to the oven for an hour. On withdrawal a pan of water is set on the floor of the oven, and left for about two hours, or till the space is filled with vapour. A final stoving for twenty-four hours in this medium finishes the operation.

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THE ORANGE.

If there are any fruits respecting which the Cape grower should by this time have accumulated a good working experience, they are—first, the grape, and second, the orange. It will hardly be said that the culture of the latter has been dealt with skilfully. Success and failure both seem to have come by the chances of site and soil in most instances, and there appears to have been little consideration of the requirements of the tree and careful selection of places where those conditions will be fulfilled.

Perhaps the first datum to be taken in orange culture is the character of the tree itself as compared with the average run of orchard trees, such as the apple and the pear. When experienced gardeners talk of this difference, they will tell you that citrus trees must be dealt with more or less as *hard-wooded stuff*. To them that phrase means a good deal, and implies doing many things and not doing many others, care respecting which is not so much required with soft-wooded stuff. The root-system is far more delicate and finely fibrous than in the latter. There is therefore

demanded special care in the preparation of the soil and in the drainage and aëration. Perhaps this touchy fastidious disposition reaches its climax in heaths, azaleas and rhododendrons. So short is the portion of their root-fibres that is physiologically active, that a very slight deprivation of the air they require brought about by over-watering, or a temporary lack of moisture, is enough to kill them. The gardener therefore makes his potting composts for these plants very porous by the addition of fibrous peat and sand, is extra careful to have plenty of drainage-crocks at the bottom of the pots, and to water just enough and no more at short intervals. Now the orange and the citrus tribe generally are far from being equally fanciful, but their conditions of health and longevity—so far as the roots are concerned—are precisely similar in kind to those of the above typical series of plants, and differ only in degree. Consequently citrus-culture, to be a permanent success, must be founded upon fulfilment of these natural peculiarities of the tribe. All citrus trees require certain special cares in planting from the nursery. Their roots are naturally horizontal in direction and spread near the surface, keeping to the best and most fully aërated part of the soil. It follows that in planting, the roots should be spread well out upon the bottom of a hole of proportionately large diameter, and made to radiate as equally as possible. If the locality requires that the tree be supported for the first few years because of prevailing winds, the stake, with its lower end charred to preserve it, may be driven down into the subsoil at the time of planting, and thus the operator will escape the chance of destroying a principal root-branch by forcing it in blindfold after he has covered up the roots out of sight. As these trees are liable to gumming and bark-canker at the collar if it be kept wet, it is of great importance that they be not set deeper than they had previously stood in the nursery. There will always be a little settlement after planting, because the earth employed in filling is very loose, and this sinking may be allowed for within reasonable limits.

Whatever has been said respecting the physical character of a perfect soil, viz., the loose texture of its particles admitting air throughout the mass, their surface attraction

causing a water-film to envelope each without closing up the air-ways around it, and the absence of colloidal clay to interfere with capillarity, applies to the requirements of an orangery with more force than to those of an ordinary orchard. Where the owner has to complain of the gradual decay of his citrus trees, one dying out after another, there are mostly two causes at work, acting singly or together. They are—unsuitable conditions of soil and treatment, and—insect and fungous plagues.

The whole citrus tribe differ considerably from the ordinary orchard trees in their relation to the yearly output of new wood, foliage and fruit. Hence they cannot be treated in the routine methods of pruning which have been described, nor can they be shaped to the truncated cone pattern which answers so well with dwarf trees generally. It is absolutely necessary to encourage the axial growth and thus have a tree with a more or less pyramidal outline. This varies considerably by lengthening of laterals, so that the pyramid may become very obtuse at the top, or the head may tend towards a globular shape. But in all cases well-grown examples keep their main axis undisturbed, and naturally resemble the style given to other trees by pruning to standards. Generally speaking, citrus trees balance their growth very evenly if they have started well and are in a suitable aspect; consequently, the pruning knife has but little call to interfere. All that is necessary is to cut out dead wood and the long ill-placed wastrels which often fill up the centre of the tree and prevent sufficient access of air and light. Whenever a cut has to be made near an inch in diamater, the edges should be carefully pared all round, so as to ensure adherence of the bark along the line of section, and the wound brushed over with a little oil-varnish or a solution of shellac in spirit. Tar should not be used, except as a matter of makeshift. Mature trees blossom and bear the fruit very near the end of the branchlets, and the next season's fruiting growths start from behind as new laterals, which overtake the previous season's bearing-twigs, just beyond them, and fruit in their turn. It is this peculiarity which produces the evenly rounded outline of a well grown citrus tree, and also renders unnecessary the continual shortening in which is required for

the peach and similar trees. In case a branch of unusual vigour should push out so as to interfere with the balance of the head, it is best to cut it well behind the average length of its neighbours, and if possible, to a shoot on the lower side. By this means the vacancy will be sooner and more regularly filled up, and the common outline restored. But let it be remembered that the citrus tribe are impatient of the knife, and that one cause of the failure of many orchards is the original mistake of setting the little nurslings too close, say twelve feet apart, when first planted, and subsequently being obliged to keep cutting at them when they mature and begin to jostle each other with a bare six feet of space left to each all round. The prophetic eye of the planter should see as in a vision what the trees will become in a dozen years time and give them fair play and full twenty feet or more to divide between the future spread of every pair.

The ease with which some kind of an orange may be obtained by growing the seed, has, just as in the case of the peach, been the cause of the Colony being furnished to a very large extent with trees bearing indifferent fruit. Of these the most common seem to be derived from the well-known Bahia orange of Brazil. Over fifty years ago one of the patriarchs of fruit growing at the Cape, Mr. Joachim Brehm of Uitenhage, became much dissatisfied with the low class of orange then grown in the Eastern Province, and introduced direct from Rio several young trees of the true Bahia. From these, by careful bud-propagation large numbers of this variety were dispersed far and wide, and although the pernicious habit of allowing seedlings to fruit has deteriorated the market supply, yet this most excellent orange is in high favour and buds or grafts are readily obtainable. Other seedling sorts are rather to be referred to the large St. Michael and the Portugal orange. It would therefore appear that the Colony possessed in the first instance excellent named sorts of this delicious fruit, but by the cultural error of propagating by seed, a mongrel race has sprung up which does justice neither to the exceptionally suitable climate of the Cape nor to the possibilities of the fruit itself.

It may be worth while to quote the words of an eminent Florida grower upon this point. He says: "Do not let any man or number of men in a pomological convention induce you to establish a seedling orange grove. If you do, you will some of these fine days wake up from a Rip Van Winkle dream and find yourself as far behind the age and times as he is represented to have been. No two seedling orange trees will ever produce fruit exactly alike. Consequently your fruit will become promiscuous and variable in character and quality. You know what bad business that is. Your neighbours, who have selected known and uniform varieties, will find a more ready demand and sale at full 50 per cent. advance on what you can get for your mixed promiscuous fruit. Besides budded trees fruit much earlier than seedlings. We choose certain standard varieties, noted for their fruitfulness and excellence, and reject all others. Then we bud on two-year old seedling stocks, and invariably get fruit in two years. Now, seedling trees may be eight, nine, or even ten years in coming into bearing, and after all this delay one only gets 20 dollars per thousand for them, while 40 to 50 dollars per thousand come easily for our selected varieties. They are nearly twice as fruitful as the seedlings, and in some instances produce four times as much. We bud the Navel (that is the Bahia), St. Michael, the Blood Orange, and the Mandarin. The sooner your Californian fruit-growers understand this the better it will be for them."

So much for making a judicious selection of two or three sorts and growing them only. Which are these to be? And are there no nameless fruits here and there in the Colony which are good enough for the purpose?

It is perfectly true that amid the multitude of seedlings which have arisen here growers have, as was to be expected, had the luck to raise a few good sorts equal to many that are preconized and made so much of in Australia and Florida. Perhaps one in a couple of thousand may be worth perpetuating, and the lucky raisers who can bring them forward as equal to the Bahia, the Mediterranean Sweet, or the small St. Michael, and find their judgment endorsed by experienced buyers, had better at once distinguish them by a name and give them a permanent

standing on the local market. But in all these cases the essential points of smoothness of skin, thinness of rind and rag, juiciness of sections and tenderness of membrane, besides the sweet liveliness of flavour that goes to a good orange must be present. Otherwise it would be far better to let the seedling be lost in the crowd.

Sorts of Oranges Recommended.

Bahia.—Fruit large, solid and heavy; skin fine in texture, smooth, fairly thin; pulp firm, very juicy and full flavoured, nearly seedless; central pith small. Tree of medium height and moderately thorny, rapid in growth, rather tender in cold localities. Seedlings of this fine variety are to be found nearly everywhere, and are mostly poor descendants wandering away from the original type. The Americans have changed the name of this orange to *Washington Navel* for patriotic or trade reasons, but the history of its introduction into the States from Bahia is perfectly well known. There is no reason why Cape growers should follow suit in changing the name under which it was introduced to them by Mr. Brehm long previously. It is known to pomologists as the "Bahia," and occasionally, eastward, it gets on our markets the local name of *nipple orange*. The choice lies between these two, and the former is the better name.

An Australian variety, probably a lucky seedling and one of the thousand, is known as the *Australian Navel*. Its flavour is as good as the prototype, but it pollinates badly and is apt to cast its fruit when about half an inch in diameter. Another peculiarity is that the fruit is variable in size, large and small examples of equal ripeness growing together. The nipple is comparatively large and prominent, and the fruit will often split at the junction with the true skin. These characteristics will mark it out as a sort to be avoided.

St. Michael.—Fruit round, large and slightly oblate, solid; rind thin, close texture; pulp close but not hard, membranes tender, generally with a few small seeds. Alters much according to locality. In congenial situations, with proper shelter, it is very prolific; but in cold, high

situations it becomes shy of bearing, and the rind thickens considerably. Many indifferent seedlings of this sort exist at the Cape, and show a coarse skin, loose abundant rag and tough membranes enclosing numerous seeds.

St. Michael (*Paper-rind variety*).—Fruit small, globular, very firm and juicy, and of excellent flavour; rind thin and pale, rag insignificant. Being a late ripener and slow to drop from the tree it is a good sort for local sale. The fruits are singularly uniform in size, hence they pack and travel well. The tree is a good bearer and much hardier than its namesake. It is of dwarf size and therefore is well adapted for garden growth.

Valencia Late.—This is much like the Paper-rind St. Michael in texture, thin rind and juicy firmness. It is however larger and somewhat ovoid. The tree does not begin to bear so soon as most budded varieties, and this peculiarity is in its favour, for it is thereby enabled to mature its vegetative growth without being checked by precocious fruiting.

Mediterranean Sweet.—Fruit excellent, ripening late, varying from medium to large, skin smooth, pulp firm, seeds few. The tree is rather dwarf, and as thorny as the Paper-rind. It generally requires thinning to prevent overbearing.

Joppa.—Raised in California from seeds obtained in Syria. Fruit large, uniform, firm, ringed at the summit, rind thin, and deep orange red, seeds few or none. An early and abundant cropper of tall vigorous growth, leaves large. An excellent all round fruit, fit for export, being fairly sweet and flavoured before colouring.

Maltese Blood.—Many seedling varieties of unequal merit are to be found at the Cape. The fruit of the best sorts is rather small or medium, distinctly oval, with medium rind and pulp mottled with red. It is advisable to see and judge of the fruit before accepting buds or scions of any particular tree for propagation. The curiosity of the red pulp often leads the owner to overlook the disability of a thick, spongy rind, and to offer material decidedly dear even at a gift.

Bitter Seville or Bigarrade.—This is the tallest and hardiest of the orange genus, and will stand very cold

winters if protected from the wind and irrigated intelligently. Its flowers are the source of the valuable Ol. Neroli, which some day perhaps we may turn to account. The fruit is of medium size, smooth, with a thin fragrant rind, and but little rag; pulp very bitter and acidulous. It is the only proper material for making first-class marmalade, a preserve which is intended to be a sort of pick-me-up, or incitement to a breakfast appetite. Here it is often made of the common market oranges, and is mawkish to a degree. The function of the pure bitterness is lost. It is as if one should preserve olives in syrup. The great value of the Bigarrade is however as a bearing stock, for which its robust constitution and non-liability to disease specially adapt it. Much has been written on this head, and probably in a few years we shall hear very little of citrus fruits on lemon stocks, except as a history of the past.

Mandarin or "Naartje."—This orange is as distinct a species from the ordinary orange as is the lemon or the lime. It is one of the citrus trees which, like the peach among stone fruits, rises from seed with comparatively less loss of inherited qualities. Seedling Naartjes of good quality are pretty frequent, but it is not advisable to have recourse to growing from seed *except for stocks*. A fairly long experience of this delightful little tree goes to show that fruiting seedlings are very apt to prove capricious bearers, giving a bouncing crop for one or two years and then next to nothing for the next year. Sometimes they refuse to set their blossoms or even to blossom at all. These disabilities do not occur with trees budded from good select kinds.

The sorts are very imperfectly known by name here. The Emperor Mandarin is decidedly the best of all, both for quality and fruitfulness. The fruit is much flattened, rind deep orange, delicate, fragrant, closely adherent to the segments. What rag exists is close textured instead of being fluffy and loose. The pulp is deep orange in colour, juicy, and at once deliciously sweet and acidulous. The tree is the largest leaved of its kind. The Thorny Mandarin is a variety of the Emperor with a different habit, as its name imports, and a smaller leaf. It is specially hardy and bears freely, but the fruit is small. The quality of the pulp however is not inferior.

The Scarlet Mandarin.—This is a larger-sized tree with a tendency at first to make axial growth and afterwards to spread out laterally. The fruit is fairly large, often equal to the Emperor, sometimes obscurely ridged like a tomato. The rind is deep dull red, not so lively in fragrance as the other sorts, and ultimately becomes almost detached from the sections, giving the fruit an unpleasant podgy feel. The rag is loose, fragmentary and scattered, and the flavour is more or less mawkish, wanting acidity and crispness. Of the Mandarins, however, it is the tree which best will stand tropical heat. For Cape growing, it is not to be named as a competitor of the cling-rind Emperor.

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THE LEMON.

The Lemon has not been much of a success at the Cape. There has been little effort till lately to get first-class known and marketable varieties, and the plague of seedlings has had more visible effect on the market lemon than on the orange. It is truly pitiful to see the large imports of Sicilian and Lisbon lemons coming over six thousand miles by sea to the country which could grow them quite as well, if not better, than either of the countries exporting them.

The lemon is considerably more delicate in constitution than the orange. It will neither put up with sudden vicissitudes of climate nor the alternations of care and neglect which the orange would more or less successfully support. The proof of this fact is to be found in many a garden and orchard where the citrus trees are going back from year to year. The lemons invariably die out first.

With regard to climatic conditions, the lemon cannot be expected to give profitable results in localities where sharp spells of frost are to be dreaded in winter. As little will it thrive in those nooks of hot and humid coast-land, where we ought to be growing pine-apples and bananas. Probably the altitude of the upper plateau, 3,000 to 5,000 feet above the sea, will, except in a few sheltered and exceptional localities, never produce the lemon in perfection. The base of the first slope inland and the plateau above the

elevation being from about 700 or 800 feet to a maximum of 2,000 feet will supply the conditions requisite for producing perfect lemons. It must be remembered that the fruit is somewhat peculiar. It has to mature and ripen, but that ripening process stops short of the conversion of fruit acid into sugar, a change which constitutes ripeness in almost all other fruits. Hence a cool summer and a short duration of autumnal heat is sufficient for its needs, while under such conditions the orange would fail to attain its maximum sweetness. In fact, the lemon belt of a country like the Cape Colony cannot quite coincide with the orange belt, and there will always be many localities where one of the two fruits comes to perfection, while the other fails to do more than reach mediocrity. If, however, the lemon must necessarily be grown together with the orange, it is more important to avoid winter cold than great summer heat. The slower continuous maturing required for the former may to a certain extent be provided by a skilful storage, ripening following an early period of gathering from the tree.

The Cape custom of using the lemon as a stock for the orange has led to the multiplication of seedling lemon trees. So much has been written upon this subject, and the universal practice of European countries has so emphatically endorsed the wisdom of using the Bigarrade or Bitter Seville Orange as the healthiest and strongest citrus stock, that little additional remark need be made here. It is on this stock that even the lemon itself should always be worked, and, owing to its hardiness and powerful root-system, the fruit may be successfully grown on it in situations where on its own roots it would miserably fail.

Hence in purchasing budded lemons of named sorts, a warranty should be required from the nurseryman that the stock is the bitter Seville.

What has been said of the orange as to planting and general care applies equally to the lemon, with but little difference. Its bark is perhaps somewhat more apt to damage from sun-scalding, and hence it is advisable to train it to a lower branch-growth for self-protection. It is also more prone to make long useless water-shoots, and these are far better pinched out at an early stage than left for the seasonal pruning.

Sorts of Lemons recommended.

Lisbon or Portugal Lemon.—Fruit of medium size and fairly uniform, rind smoothly grained, not bitter, pulp juicy and briskly acid, seeds few, keeps well, and is available longer than any other sort. Tree rather large, strong growing, fruitful, very thorny when young.

Sicilian.—Medium size, rind smooth, thin, dense and tough, not bitter, membranes thin, pulp juicy, strongly acid, fragrant, tree prolific.

Villa Franca.—Fruit medium, pointed oblong, rind thin, not bitter, pulp juicy and strongly acid, seeds few. Tree hardy, spreading, somewhat drooping, nearly thornless. One of the finest lemons known. Keeps well.

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THE CITRON.

The Citron is as large a tree as the Bigarrade or Bitter Seville orange, and is even handsomer in appearance. It is very hardy, and will do well throughout the whole region which we have termed the orange belt. The flowers are large and purplish on the outside. The fruit is oblong and rather clumsy in appearance, frequently growing very large and weighing as much as three or four pounds. The skin of the fruit, when fit for plucking is of a beautiful waxy green tint which, if left upon the tree turns ultimately to a bright clear yellow. There is a very considerable thickness of rind within, which is coarse and only slightly bitter. The subacid pulp is useless. It is the rind alone which gives value to the fruit, being prepared as a confectionery sweetmeat, by the process known as candying. The considerable imports of candied citron peel into this Colony show very plainly that a citron grove would pay a good return for outlay and labour, for there is now no lack of manufacturing confectioners here who know how to turn it to the best account. The tree comes fairly true from seed, but should be budded from first-class selected varieties upon the bitter Seville stock to ensure hardiness.

THE FIG.

Of all fruit trees the Fig is perhaps the least particular as to soil. It will give good results in almost any soil capable of cultivation and not hopelessly barren. It has therefore a wide range of usefulness, and one is surprised to find it so sparingly brought forward commercially. Wherever in this Colony the winter minimum temperature never sinks so low as to kill the tree with frost, one may depend upon getting a summer heat quite sufficient to ripen the fruit. But, of course, the places where the fruit can be grown to a market profit will lie far within this winter extreme. Moreover, not every sort of fig which will grow and bear well will fulfil the conditions required for a first-class *drying* fruit. Many excellent table sorts are of no use for drying purposes, and it is to the production of a first-class dried fig that the grower has to turn his efforts.

Table figs by reason of their softness and speedy breaking up can only have a limited market area. Besides, the fig harvest is apt to come on with a rush, to glut the market, and disappear. Hence low prices induced by every man's anxiety to sell during the few weeks of the season. This peculiarity leads naturally to the device of selecting for the main crop the sorts which are found to dry best, and thus get a permanently valuable return which may without deterioration be held to await a rise of prices.

Besides choice of sorts in the above point of view, it must be understood that the cultivation must likewise be directed to the same end. A drying fig must be large. The little, hard buttons often shown as Cape figs will not do at all, except as dreadful examples of what to avoid. But, with a good average size, there must be firmness of flesh and no excess of moisture. Hence the cultivator has to exercise a wary judgment in the use of irrigation water. It must be run in when wanted by the trees—not simply when the owner's turn comes round. Excess of watering, even when the drainage is perfect, as it very seldom is, tends to produce fruit which dries slowly, shrinks greatly, and becomes tough, or, if the soil has been richly manured, may even cause the trees to run away to mere wood and

foliage. These points are here made out to show that if figs good enough for eating while fresh may be grown without intelligent care and thoughtful suiting of means to the end required, it is far from being the case with figs for drying.

The fig tree will get up, if permitted, to a very large size. Californian writers tell us of historic fig trees of 11 feet in circumference of trunk at the ground level, and 9 feet a yard from the ground. Fig groves are described shutting out the sunlight and making a shady twilight as of a cave. We have not these wonders to describe in our newspapers, and it is perhaps just as well we are without them. One occasionally sees examples 20 to 30 feet in height, but they are generally *solitaires* that have grown large through mere letting alone on suitable situations where they have not been encouraged to bulk thus large of set purpose. If at all numerous, such trees would require to be set out over thirty feet apart, and great waste of space would ensue. As with other orchard culture, it will be found that dwarf trees are most economical both of land and labour, and their produce is far more easily and safely brought to the basket. The following is advice from a practical grower:—"Figs are long-lived and strong growing trees, and should be planted further apart than any other fruit trees, especially the strong growing kinds like the Large Purple and White Adriatic. Others, as the White Ischia, are not such strong growers, and may be planted closer, but even they want plenty of room. I would recommend planting from twenty to thirty feet apart. Then fill in between with vines, peaches, plums or quince—something that can be taken out at the end of eight or ten years, or as soon as the fig trees want all the space. The fig and grape do well together, and I should prefer grapes as a filling if the land is adapted to grape-growing."

The fig is mostly propagated by suckers or by cuttings. The treatment of these is precisely the same as that well known and practised here with vine-cuttings. They, however, are more liable than those of the vine to dry out, and should be indulged with some of the extra care which distinguishes the garden from the vineyard. If fine

imported varieties have to be dealt with and many plants raised from a small supply of material, the one-eye fig cuttings, with bottom heat and over-head frames, will succeed quite as well as will one-eye vine cuttings. Budding and grafting can also be done, if desired, but quickness and an assured skill are required just as with all other milky-juiced plants. Experienced gardeners, however, rightly discourage these methods of propagating, because of the impossibility of preventing the fig stock from perpetually asserting itself with abundant suckers, and they will probably never be carried out here save to utilize trees that remain persistently barren year after year. Young fig-cuttings which have struck recently are rather tender to transplant. No time, therefore, should be lost in transfer from the nursery to the orchard ground, and special care should be taken in packing for transit.

Growers are not agreed to the height at which young trees should be headed back, but on the whole the dwarfing plan is recommendable. The rampant growth of the fig demands that not more than three leader shoots should be allowed to remain, and these should very equally divide the circle of the future head. Cutting to inside buds in the early shaping is the general rule to correct the somewhat natural sprawling growth of the tree, and when the outline is once obtained pruning is very little required save to cut out here and there an ill-placed branch which crosses its neighbours.

Fig Drying.—There has been very little written respecting the drying of figs in the pages of the *Agricultural Journal.* Hence, though not exactly in accordance with the plan of this little treatise, it may be well to give a few remarks upon the practice as carried on elsewhere.

Supposing the sorts have been selected and grown to perfection. The preparation of first-class dried figs begins with the gathering. No heavy-handed clumsy person can pick figs—they must be handled delicately if they are to do any good. Every one must have the stem well on, all being rejected that are broken off leaving it behind on the tree. Pick into a light wire or chip basket hanging on the left arm, for fig-picking requires both hands. From the basket the fruit is laid carefully on the drying trays, all pointing

the same way, and none touching its neighbour. In doing this, have a keen eye to the grading for size, and average them to first, second and common as you lay them out. When enough trays are filled to make a full charge for the sulphuring chamber, run them in, set out enough sulphur to burn for twenty minutes and let them stop in the fumes for one hour. Then remove them into the sunshine on supports of a height convenient for the frequent hand-turning the figs require. Every fruit has to be attended to separately, and when one side bleaches out the other must be turned up. At sundown they must be run under cover. In about three days, with good drying weather, they will be so far dried out that they can be "rolled," as it is called, between the fingers and thumb to equalise the softness of the contents, but the greatest care and dexterity is required for the first rolling lest the skin be broken. After another day's drying, they are rolled again, and witl bear a good deal more force. The manipulation ends by pulling each fig out even and flattening it just as the Turkey figs in the boxes appear. In another day, or perhaps two, the fruit is what is technically termed "dry," that is, properly cured for keeping. But the word "dry" does not mean dry in the usual sense. The fig is still soft, yielding fruity glucose-laden tissue. You can of course keep it out in the sun a week longer, and dry out of it all the moisture. The skin will be as tough as biltong, the flavour utterly gone and the fig itself fit only for the knob of a walking stick or a coat button. Once overdried, figs cannot be restored to softness. The curing having proceeded far enough the trays are stacked one above the other in a shed or storehouse for a day or two. The figs are then packed into the "sweating boxes," in which they remain loosely lying for a few days, turning the contents upside-down every day. That is for the purpose of averaging mutually their amount of natural moisture. The next process is packing. The figs are prepared for this by dipping in hot water to which a little salt, a pound to 25 gallons, has been added. The dip is done by means of open meshed wire baskets swished rapidly through the hot liquor twice or thrice. After draining the figs are laid out on the trays and covered over to keep off flies. In about 18 hours they are ready for the boxes.

Every fig dryer should have his own fancy lining for his boxes; the nattier and more catching to the eye the better. The linings are laid in upon what is to be the top side of the box when opened, and some packers lay in two or three dried leaves of the sweet bay which we at the Cape might improve upon with the lovely silver tree foliage dried flat for the purpose. The fruit is then pulled and flattened and fitted in with the greatest care, thick and thin end alternately, and carefully turning over any hard stem that might wound the next tier of fruit. When the level of the sides is reached and a little overpassed, say by a full half inch at least, the wood slat that is to be the bottom and an intervening piece of paper are laid on. A dozen or more boxes thus prepared are then put aside under some simple arrangement for an even springy pressure. This is sometimes effectively done by long laths bent like a bow, one end reaching the rafters overhead and the other pressing on the boxes. In a short time the soft figs yield and mutually accommodate themselves to the decreasing space. When the bottom slat is all but touching the sides it is smartly nailed on with small neat wire nails. Then follows the usual routine of stencilling or branding in the trade mark, the quality and number of pounds guaranteed in the box.

Sorts of Figs.

Black Geneva.—Fruit large, oblong, very broad at the top, tapering thin to the stalk. Skin purple-black with rich bloom. Flesh dark red, juicy, very sweet and luscious, a hardy and prolific sort.

Blue (or black) Ischia.—Fruit medium size, turbinate, flattened at the top. Skin deep bluish-black. Flesh deep red, sweet, luscious. Hardy, prolific and early bearing. Ripens earlier than the Black Geneva.

Brown Ischia.—Fruit medium, rounded, rather apt to crack and twist if over-irrigated or in wet seasons. Skin chestnut brown. Flesh reddish-purple, sweet and high flavoured. Hardy, strong-growing and prolific and ripening early.

Brown Turkey or Naples Fig.—Fruit large, oblong pyriform. Skin brown red with a thick blue bloom. Flesh red, sweet, luscious. Hardy and prolific, ripening early.

Castle Kennedy.—Very large, obovate. Skin dull brown mottled with grey. Flesh pale reddish at centre, tender, sweet, but not highly flavoured. Hardy, robust, prolific and ripening very early.

Smyrna.—There are several closely related varieties which go under this name. It is the best of drying figs. Fruit medium, very sweet, firm and richly flavoured.

White Adriatic.—Fruit fairly large, pyriform, short stalked. Skin yellowish green, very thin. Flesh clear, red, drying yellow, very sweet and rich. A good drying fig. Hardy and prolific.

White Genoa, or Grosse Marseille.—Fruit large, obovate, rounded, short necked. Skin greenish yellow, spotted. Flesh pale red, sweet and highly flavoured. Not very hardy and bears moderately.

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THE WALNUT AND CHESTNUT.

These two valuable trees have hardly yet received the attention they deserve, and the tendency to treat them as something akin to forest plantation trees rather than orchard stock militates against their due estimation and careful culture. The walnut absolutely requires a deep rich soil with plentiful moisture deep down under the superficial layer, if it is to make an adequate return for the comparatively large space it demands. It certainly will grow to wood if parsimoniously treated, but its marketable return in such condition is only small. Hitherto it has almost always been reproduced by seedlings from selected nuts, and consequently the ordinary Cape Walnut of the market is variable and often small. It is also a fact that some seedling trees will remain persistently barren even when fifteen to twenty years old. Of course, the care and discernment which go to the production of other fruits will equally beneficially affect this one, and at least one attempt

known to us has been made to import and propagate the very best sorts known from France, in which country very great attention is paid to the improvement of the race. Either budding or grafting may be adopted, and even large trees of unsatisfactory product may be improved by these means. They are to be headed back in the off season, and when fresh shoots have started for the following season a few are selected for future growth and worked upon by annular or ring-budding, the rest being cut out. It is important to note, in grafting the walnut, if that mode be preferred, that the common split-graft should not be used, or at least if tried, the section should never cross the central pith. It is better by far to cut out an angular wedge-shaped groove and cut the scion correspondingly to fit in sideways. Even the scion should be cut as to expose little or none of the pith. Inserting a scion after the manner of a bud is also a good method. Quickness of manipulation, very sharp tools, and unusual care in covering up with grafting wax or its equivalent are desirable. On the whole, for this climate, low grafting and covering with a generous heap of soil for a season is advisable, but the formation of accessory rootlets from the scion must be guarded against. As the walnut is late in starting its sap and in leafing, it is necessary to collect the scions in advance, and keep them over, stratified in sand just moist enough to hang together, until the stocks are fairly under weigh with their spring buds. The pruning of these trees is very simple. The axial centre growth should not be headed back, for it is inadvisable to attempt a dwarfed pattern. The lowest laterals should start from $3\frac{1}{2}$ to 4 feet from the ground, and be allowed to spread enough ultimately to shade the ground occupied by the roots, and with young standards it is quite worth while to protect the bark so long as it is tender with some suitable sun screen on the north side. Any young shoots killed by sunburn and hot winds should be cut back to the quick at once to prevent the branch dying back. The fruit ripens in a leisurely way and never all at once, hence it is not advisable to make a harvest straight away. It is better to collect the droppers first, and every week to go over the trees with light rods to dislodge the largest fruit, the

earlier lots meanwhile being exposed to the air in the shade on frames to dry sufficiently for storing, covering them up at night. If thus treated for about four days, and turned over repeatedly, they will be dry enough, but will require a little vigilance to prevent any mouldiness supervening inside. The soft-shell walnuts require close attention so as not to carry the desiccation too far else they are apt to crack, let in air, and shrivel the kernels. All are best temporarily stored in boxes until marketed in the usual way in bags. The custom of bagging at once and standing the bags on the more or less damp earth is the main reason that there are so many musty walnuts about. In Kent it is usual to wash over the whole gathering with clear lime-water and then dry quickly in a draught of air. The result is that the brown, inner skin peels off very readily and the flesh gains in plumpness.

There are many good varieties known in France and grown carefully to name. *Præparturiens* is the earliest to bear, as its name implies. Nursery plants only shoulder-high will bear a little crop where they stand, although this should not be allowed. The nuts are of fine quality and good average size.

Serotine is not quite so well-flavoured and a little dry, but as the tree does not trust itself to leaf or blossom till a week or ten days after the average of other sorts, it has a special value for high cold localities liable to late frosts. The shell is apt to thicken and prove hard if the soil is poor, thin and dry.

Mayette and Chabert.—Both of these are good croppers, hardy and rather large fruited. They are perhaps the most common sorts in cultivation in France, and are seen in the markets everywhere.

Bijou.—This is the largest walnut in cultivation. It is sometimes shy of bearing and capricious, but mostly through not getting its demands satisfied properly. The nut is of first-rate quality.

The walnut is remarkably free from parasitic enemies of either kind. The only one to be feared is the red spider, *Tetranychus telarius*, which spins its microscopic webs on the under side of the leaves and produces a sickly condition, especially in dry seasons. The persistent use of

paraffine emulsion with the spray-pump, using the finest nozzle available, directed *from inside* the tree to take the enemy in the rear, speedily disposes of the difficulty.

Complaints are often made of walnuts not germinating when sown, and of difficulty in transplanting them from the nursery. The real reason is the general carelessness with which the nuts are stored and the frequency with which a fungous mould is allowed to penetrate the shell. The walnut is naturally very slow in germinating. The seed-bed should therefore be well trenched and drained and be so deep as to preclude chances of its ever drying out below the depth of the seed, or requiring heavy waterings. The nuts should be planted with the outer shell still on, and not more than a full inch below the surface. When seedlings have completed their second season they should be transplanted, because the habit of the walnut, like that of the oak, is to develop an enormous tap-root with comparatively few lateral expansions. By transplanting, this tendency is overcome, the descending axis is cut smoothly off and a fine output of subsidiary lateral roots follows. If the walnuts are sown where they are intended to remain, and if there is not underneath a barren subsoil, a rocky or a watery substratum, transplanting may be let alone. But it is the safest course all round.

Attention is directed to the reports of the late excellent Forest Officer, Mr. J. H. Cooper, upon the growth of the walnut in the districts of Cango and Oudtshoorn, given in the Report of the Superintendent of Woods and Forests for 1888, pp. 39-40.

As with the walnut so to some extent with the chestnut, the French growers lead the way. It is less choice as to soil and will succeed on soil altogether too heavy for the walnut. But it is more likely to deteriorate or throw back in seedlings than is its companion, and very many trees bear mere empty burs all through their useless lives. Hence there is the more need to be careful in selection and in working. It succeeds best by annular budding, but may be side-grafted with a little care and by the intervention of the earth mound. The seedlings should be treated by transplanting, the same way as the walnut, left a season, budded, and afterwards planted out in the fourth year at farthest.

The best sort every way is the large sweet *Marron de Lyon*. Another good French variety is *Combale* or *Cambalu*. In England the popular sorts known to growers are *Knights' Prolific*, *Devonshire* and *Banks*. In both these trees, if the seeds are to be kept over for sowing, or sent to a distance, much disappointment will be saved by stratifying them immediately on gathering in small foot-cube boxes with sand or a mixture of sand and ordinary earth, and storing in a cellar at an even temperature till required.

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THE QUINCE.

The quince grows so readily in the bush form, and produces such heavy crops of fruit for which there is only a very languid market at present, that it scarcely seems necessary to say much about it here. Certainly the quince is not prized at its full comestible value, perhaps because it is so cheap. Yet it would be well worth while, now that jam factories are at work among us, to pay more attention to this fine fruit. The quince is best grown as a low standard; this implies letting the central axis of the tree get up, and working the laterals so as to make a pyramid shape of it. Under any system the tendency of the tree to run out into long, lanky shoots must be checked, and fully as much as half the new growth of the year will require cuting back. If this is not done, the weight of the fruit acting with the long leverage of the branches will be apt to snap them off. When the rooted cuttings are planted in place, it is well to keep an eye on the buds just when they begin to swell, and to rub out the weakest two of the three which often appear together. This will prevent the tree from wasting itself and will secure a neat, clean growth. By far the best method for raising quinces of fine quality is to graft selected sorts upon pear stock for standard growth. If this were generally done, there can be little doubt that this fine cooking fruit would take its proper place on the market and would be much sought after, instead of being a sort of pariah of the orchard. The

varieties that have arisen here as seedlings are very numerous. In selecting a good sort regard should be had to the quality of the fruit when cooked. Many quinces do not colour well and exhibit hard spots here and there in the flesh. There are also sorts that are subject to a fungus blight, *Entomosporium maculatum Lév.*, which makes havoc among the leaves, causing them to turn brown and fall. The result is imperfectly nourished fruit.

Quince trees of the newest and best varieties have been introduced of late years, and are now to be had of nurserymen. It would therefore be well to take some care in selection of sorts, instead of being content, as heretofore, with a bundle of cuttings from the nearest hedge.

Spray Calendar.

COMPILED BY THE GOVERNMENT ENTOMOLOGIST AND PUBLISHED BY THE BOARD OF HORTICULTURE.

THE object of this Spray Calendar is to enable the fruit grower to see at a glance what treatment should be given to his trees to avoid or check injury from specific insects or diseases. Only such insects and diseases are mentioned as are known to be present and injurious in the Colony. It is impossible to give technical information within the scope of this calendar, but descriptions of all or nearly all of the insects and diseases herein mentioned have been published in the "Agricultural Journal," to which the reader is referred. Information in regard to these, or to any particular insect or disease, with recommendations for treatment to remedy or prevent the same, can be had of the Department of Agriculture upon application to the Secretary, or to the individual officers.

Specimens of the insect or of the disease should accompany the letter in all cases possible, and these specimens should always be sent in a tight tin or wooden box.

The time to apply the sprays is expressed by such phrases as "When buds swell," since the actual date varies greatly in different sections. No hard and fast rules can be laid down as to how often the sprays should be used; but in general, adherence to the given directions will be followed by success. Let the treatment in all cases be *prompt*, *thorough* and *persistent*. If not effectual, communicate with the Department of Agriculture, stating just what has been done, under what conditions, and what results were obtained. The officers of the Department will probably be able to explain your lack of success, and to advise you how to proceed.

For *Red Spider* on all plants, use Paraffine Emulsion as for aphides persistently—thoroughly drenching the lower side of the leaves. Dry sulphur is also highly recommended. On plants with hirsute leaves, such as the Cape Gooseberry, Red Spiders are very difficult to destroy, as the hairs shelter them from the insecticide.

Tree.	Insect or Disease.	Remarks.	Spray.	First Application.	Second Application.	Third Application.
ORANGE ..	Red Scale, Brown Scale, Mussel Scale, Long Scale, White Scale,	March is best time to spray, or after fruit is half-grown. When possible, spray when fruit is off.	Resin Wash ..	Early March ..	Two weeks later	Spraying at any season will meet with some success.
LEMON, Etc.	Aphis	Blackish lice on young growth	Resin Wash or Paraffine Emulsion.	When first observed.	Two weeks later	
	Caterpillar .. (*Papilio demoleus*)	Hand-pick if not numerous ..	Paris Green.. ..	When first observed.		
APPLE ..	Codlin Moth ..	Caterpillar at core of fruit ..	Paris Green.. ..	When blossoms fall	Ten days later.	
	American Blight	Aphides or lice in woolly mass on stem and roots.	Stem { Resin Wash / Paraffine Emulsion }	Early Spring.	Repeat when infestation is again noticed.	
	Borer .. .. (*Cossus tristis*)	Dig borers out or pierce with pointed wire. Look for young in December and January.	Roots, Hot Water ..	Early Spring.	Remove surface soil and deluge roots. Have water almost boiling.	
	Fusicladium ..	Brownish-black spots on foliage and fruit.	Bordeaux Mixture..	As buds swell.	When blossoms fall.	14-21 days later.
	Apple Oidium ..	Powdery mildew on foliage ..	Sulphur	As for Oidium of Grape.		
			Or Bordeaux Mixture	As buds swell ..	When leaves are one-half grown.	Two weeks later if necessary.
PEAR ..	Codlin Moth ..	See under Apple.				
	Pear Slug ..	Blackish slug on foliage ..	Paris Green or White Hellebore.	When first observed (late Oct. or Nov.)	In December, if more slugs appear.	Later, if more slugs appear.
	Red Scale / Greedy Scale	Often injurious to young trees	Lime-sulphur-salt Mixture, or Winter Resin Wash.	During Winter.	As buds swell.	
	Fusicladium ..	Brownish-black spots on foliage and fruit.	Bordeaux Mixture..	As buds swell ..	When blossoms fall.	14-21 days later.

Tree.	Insect or Disease.	Remarks.	Spray.	First Application.	Second Application.	Third Application.
PEACH ..	White Scale ..	Watch for young; they are reddish and appear in September, December and March.	Lime-sulphur-salt Mixture, or Winter Resin Wash.	During Winter	As buds swell ..	Destroy young with Paraffine Emulsion, or Resin Wash.
NECTARINE	Maggot ..	Keep soil in orchard well cultivated during maggot season to expose puparia to birds, and pick up fallen fruit daily.				
ALMOND ..	Exoascus ..	"Leaf-curl," distorting the foliage and causing it to drop prematurely.	Bordeaux Mixture.. Or Lime-sulphur-salt Mixture.	As buds swell .. As buds swell ..		
	Maggot ..	See under Peach.				
	Pear Slug ..	See under Pear.				
	White Scale ..	See under Peach.				
APRICOT ..	Gumming ..	Trim away carefully with sharp knife, and cover wound with paint or grafting wax.				
PLUM ..						
CHERRY ..	Septoria ..	"Shot-hole Fungus," causing spots and holes in leaves and spots on fruit. Often mistaken for injury by insects.	Bordeaux Mixture.. Or Lime-sulphur-salt Mixture.	As buds swell .. As buds swell ..	After blossoms fall.	14-21 days later. (This will largely prevent attack.)
QUINCE ..	Borer .. .. (*Cossus tristis*)	See under Apple.				
	Pear Slug ..	See under Pear.				

BORDEAUX MIXTURE.—Copper sulphate, 6 pounds; quicklime, 6 pounds; water, 40-50 gallons.—Dissolve copper sulphate by suspending it in coarse cloth bag near surface in four gallons of water, using a wooden or earthen vessel. Slake lime in equal amount of water. Then mix the two and dilute. Ready for immediate use, but will keep indefinitely. Do not use air-slaked lime if it can possibly be avoided. If it is used, take greater quantities than of quicklime. Then when mixture is made insert in it the freshly polished blade of a knife, and leave for a few minutes. If blade then shows coppery discoloration, more lime must be added. Some persons add six pounds of molasses to the formula given. Bordeaux Mixture and Paris Green may be applied together.

RESIN WASH.—Resin, 24 pounds; caustic soda (98 per cent.), 5 pounds; fish oil (2¼ bottles), 3 pints; water, 100 gallons. Place ingredients in kettle, cover with water and bring to boil. Stir until dissolved and cook for two hours, adding *hot* water when there is a tendency to slop over. Then stir and add hot water to fifty gallons. Put in spray tank and dilute with cold water. Use while warm. Will keep. For all aphides dilute to 150 gallons. Winter Resin Wash is similarly made, but dilution is only 65 gallons.

LIME-SULPHUR-SALT MIXTURE.—Quicklime, 40 pounds; sulphur, 20 pounds; stock salt, 15 pounds; water, 60 gallons —Take 10 pounds lime, all of sulphur, and 10 gallons water; boil for one-and-a-half hours or until all is dissolved. Slack remaining lime in hot water and stir in the salt. When salt is dissolved, mix the two solutions and cook one half-hour longer. Strain, dillute to 60 gallons, and use warm. Stir while using. Slaked lime is sometimes used, but is probably less efficacious.

PARAFFINE EMULSION.—Soap, 1½ pounds; paraffine, 5 gallons; water, 2½ gallons.—Take whale oil or common bar soap; cut up and boil until dissolved in water. While still boiling add solution to the paraffine. Churn violently; five minutes if with pump or syringe, or fifteen if with paddle. Dilute, using nine parts of water to one of emulsion. Best if used warm. Will destroy aphides if diluted fifteen times.

PARIS GREEN.—Paris Green, 1 pound; water, 200-300 gallons.—For delicate foliage add one or two pounds of quicklime. Follow directions on package in mixing, and stir continually when using. Use very fine spray.

WHITE HELLEBORE.—Fresh White Hellebore, 1 pound; water, 40 gallons.—This will not burn foliage. Be sure the hellebore is fresh.

KNAPSACK PUMPS are most desirable for small orchards of young trees. Three forms are stocked in Cape Town:—The "Vermorel," sold by merchants in many small towns as well, price about 55s.; excellent for Bordeaux Mixture, but not applicable for Resin Wash or other oily or caustic sprays, unless specially fitted; the "Galloway," price 60s., stocked by Geo. Findlay & Co., and R. M. Ross & Co., a solid, well-made pump, and good for all the spraying mixtures; the "Notus," price 40s., a much smaller pump, but good for all the sprays and well worth its price; stocked by Koch & Dixie. James Robertson & Co. have signified their intention to stock all of these pumps. Not many other pumps are stocked, but any may be ordered through dealers in agricultural wares. Wm. Roe, of Graaff-Reinet, is agent for the "Nixon" pumps. They are first-class pumps and come in three sizes. Write to him and other dealers for price lists and information. In Cape Town, copper sulphate may be procured at 9d. per lb., or 20s. for 50 lb. keg. Resin costs 3d. by the lb., 12s. by the hundred-weight, or 7s. 6d. per hundred-weight in 240 lb. barrels. Ninety-eight per cent. caustic soda cost 3s. 6d. per three lb. can, or 33s. per dozen cans. Fish oil may be purchased at 4s. 6d. per gallon. Paris green sells at 1s. 6d. per lb., and white hellebore 1s. or 1s. 6d. Nearly all of the prominent ironmongers keep the articles, and many are stocked by the chemists. First try to procure them of your local dealer, and if he does not keep them, request him to lay in a stock.

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